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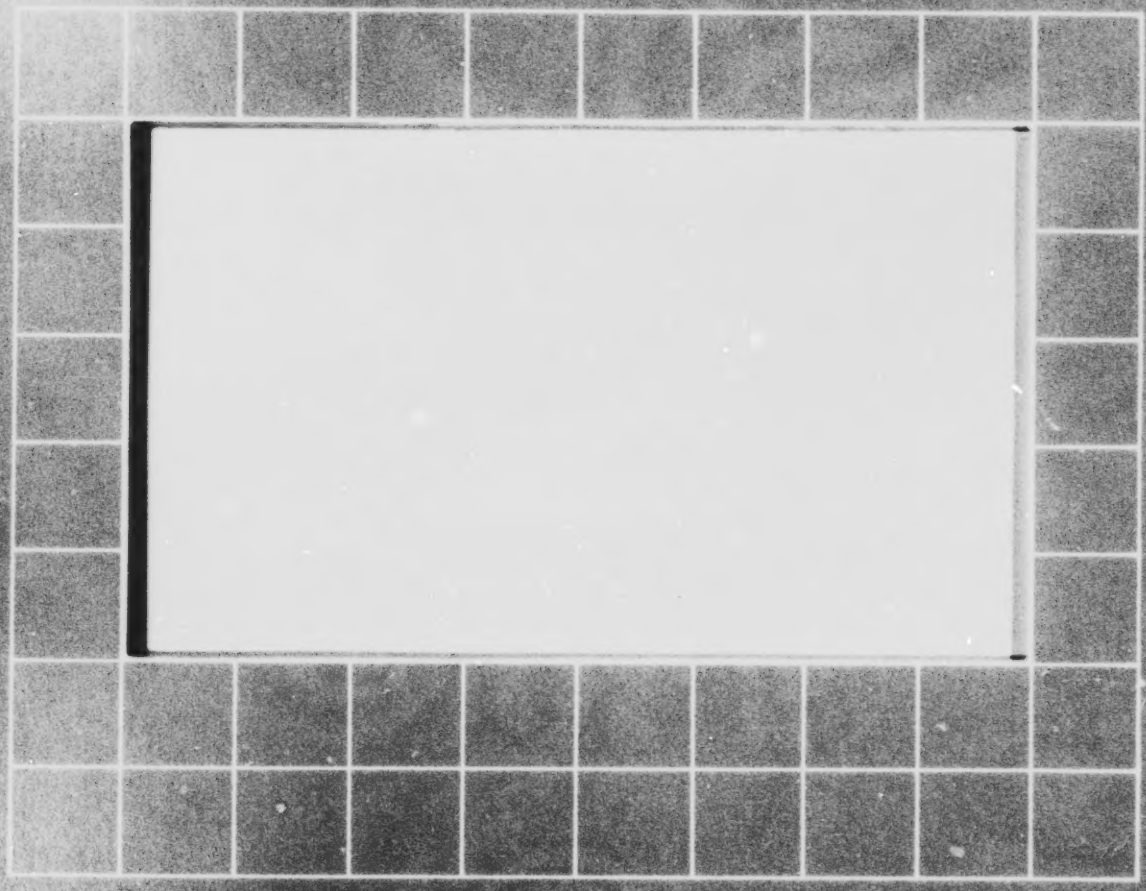
The Canadian Occupational Projection System



Canada

THE CANADIAN OCCUPATIONAL PROJECTION SYSTEM
COPS

SUPPLY

ISSUES AND APPROACHES

STRATEGIC POLICY & PLANNING
LABOUR MARKET OUTLOOK AND
STRUCTURAL ANALYSIS DIRECTORATE

JANUARY 1983

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THE CANADIAN OCCUPATIONAL PROJECTION SYSTEM - 'SUPPLY SIDE' ISSUES AND APPROACHES

I OBJECTIVES OF THE CANADIAN OCCUPATIONAL PROJECTION SYSTEM

The Canadian Occupational Projection System (C.O.P.S.) seeks to project domestic occupational requirements and supply in Canada and the provinces for up to ten years into the future. Based on comparisons of these occupational requirements and supply projections, C.O.P.S. will identify occupations in which domestic skill imbalances could exist over the time period under study. This information can be used in assessments of whether the imbalances might tend to be self-correcting or might require specific intervention by the private sector or governments. In short, C.O.P.S. projections will provide a data base for further policy discussions — discussions which will focus on the appropriateness of private or public sector actions to address anticipated labour market imbalances.

Within these broad objectives, work on the C.O.P.S. 'Supply Side' has focussed on establishing an overall 'framework' for producing occupational supply projections, as well as on identifying and beginning to assemble the extensive data needed to 'load' the framework and make it function. The balance of this paper describes the overall supply framework being developed, and

discusses a number of the conceptual, methodological and practical issues, associated with various components of that framework. Although it also addresses data questions, it constitutes neither a progress report on work done to date nor a work plan outlining future activities in the area; these are the subjects of other papers. It turns first to describe several fundamental features of the C.O.P.S. approach which affect its supply side and demand side activities, and provide much of the system's overal 'character'.

II BASIC FEATURES OF THE C.O.P.S. APPROACH

a) The Overall Supply Side 'Framework' and Approach

As discussed, the C.O.P.S. supply system seeks to project labour supply by occupational group and province. To provide this very disaggregated supply picture, C.O.P.S. intends to identify individual supply channels in each province and to estimate, by occupation, the projected annual supply from each source. Adding together the flows from all sources within a province provides an array of supply data which can be compared to corresponding demand data to produce estimates of apparent imbalances within the province. The supply estimates, in short, derive from "bottom up" approach.

In broad terms, C.O.P.S. will address the following sources of labour supply within each province:

The education system

The training system

The household sector

The armed forces

Net interprovincial migration

Occupational mobility

Net immigration

These broad outlines of the C.O.P.S. supply approach can be presented and understood easily enough. However, the objective of providing estimates of supply from these sources on an occupational basis -- the key feature of the C.O.P.S. system -- raises major conceptual and practical issues. The nature and severity of these vary with each supply source being studied, and the means to address them vary accordingly.

Although the focus of this paper is on the individual supply sources and related issues, a number of features of the supply system as a whole have already been established. These are briefly explained, below.

i) Geographical Detail

Disaggregation of estimates to the provincial level constitute a cornerstone of the C.O.P.S. approach. It is of little practical policy use if coexisting shortages and surpluses in a

particular occupation, in different parts of Canada, are disguised by an apparent balance at the national level. For effective federal and provincial decision-making in this area, therefore, the C.O.P.S. estimates are broken down to the provincial level. Estimating occupational supply and demand at the provincial level of course introduces such major adjustment considerations as the role of interprovincial migration. These must be addressed effectively in the C.O.P.S. approach, and are discussed in greater detail in later sections.

ii) Occupational Classification

The C.O.P.S. demand side projections are produced on an occupational basis consistent with that used in the ten-year Census, i.e. at the "4-digit" level of occupational detail in the Standard Occupational Classification. To permit comparisons, the C.O.P.S. supply data are being assembled at the same level of detail.

Both demand and supply projections, however, recognize that the 4-digit level may provide inadequate detail in a number of specific instances. In these cases the intent is therefore to aim, over time, at assembling data that will permit a finer degree of disaggregation, to the "7-digit" level. At the outset, however, occupational groups warranting such further detail are simply "flagged" for further reference.

iii) Occupations Selected for C.O.P.S. Focus

At the 4-digit level, there are 496 occupational groups. Although the demand side is capable of projecting requirements in each of these, there are many groups in which independent supply data are either lacking or not meaningful. Accordingly, the number of occupational groups on which C.O.P.S. work will initially focus has been reduced from 496 to approximately 270. The criteria on which this reduction has been based incorporate both federal and provincial views, and are discussed in more detail in a separate paper.[1] In summary, however, they reflect the following main considerations:

- they are restricted to occupational groups requiring more than one academic year's training, unless specific provinces have indicated a particular interest in, or have supply data on, a given low-skilled group;

- they seek to relate to occupations which are "ports of entry" into firms (i.e. in which firms tend to recruit on the open

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[1] "Revised List of C.O.P.S. Supply Side Occupations", Canadian Occupational Projection System, December 1982

labour market), except in selected industrial sectors which are the focus of special in-depth sector studies under the C.O.P.S. research program;

- they seek to exclude occupational groups characterized by an excessive variety of occupations, except in instances where one of those occupations is of particular individual significance.

It should be emphasized that this suggested list of "Supply Side Occupations" is a starting point only, and will be reviewed and amended as the C.O.P.S. system matures over time. It constitutes a basis on which the early C.O.P.S. supply work can be focussed, to make the best use of the data and analytical resources available.

iv) Other Features

While estimating occupational supply from individual supply sources, the C.O.P.S. system must ensure that when added together, these estimates make sense in the light of the overall provincial and national labour force changes anticipated during the projection period. Thus, for example, if the projected number of labour force entrants from schools, households, etc., in a

certain year greatly differs from reasonable expectations of the increase in the labour force in that year, some review and reconciliation is required. While focussing on individual supply sources, C.O.P.S. cannot ignore the expected changes in overall labour force magnitudes. By focussing on the 'trees', it cannot ignore the 'woods'.

C.O.P.S. also cannot ignore the interdependence of demand and supply, but must work towards the eventual development of a system which recognizes that imbalances in one year can carry over to affect supply and requirements estimates in later years. Similarly, C.O.P.S. cannot ignore the fact that labour market adjustments take a variety of forms. Changes in relative wages, restructuring of production processes, substitution of less scarce factors for ones that are more scarce (and more expensive), all constitute real reactions to projected imbalances.

From these points of view, initial C.O.P.S. supply side work must be viewed as the first step in the development of an increasingly sophisticated approach. Initial efforts, of necessity, will tend to produce essentially 'static' projections; it takes time, resources, and data to be able to identify and estimate the supply-demand interactions which are likely to operate. Over time, increasing familiarity with this area will undoubtedly permit considerable improvement in this respect.

Although there are many differences in the treatment of these individual supply channels, attention should be drawn to the unique position of net immigration in this respect. Far from contributing to C.O.P.S. occupational imbalances, the occupational composition of required immigration is in fact determined by the extent to which domestic occupational supplies fail to satisfy domestic occupational requirements over the projection period. No assumptions are made, therefore, about the occupational distribution of future immigrations; this is determined by the projection system itself.

Keeping in mind these major supply side considerations, the discussion now turns to trace the overall supply side framework and the relationships between its major components.

b) The Overall Supply System (Diagrams 1-4)

The C.O.P.S. supply side system is outlined in Diagrams 1-4. As noted, C.O.P.S. seeks to ensure that flows from individual supply sources, when aggregated, "make sense" in comparison to overall provincial labour force stocks of employed and unemployed. This means that estimates are required not only of flows into employment and unemployment but also of the annual stocks of employed and unemployed themselves, as Diagram 1 broadly indicates. In turn, this implies that the stock of unemployed at the beginning

THE COPS 'SUPPLY SIDE' — FLOWS & RELATIONSHIPS

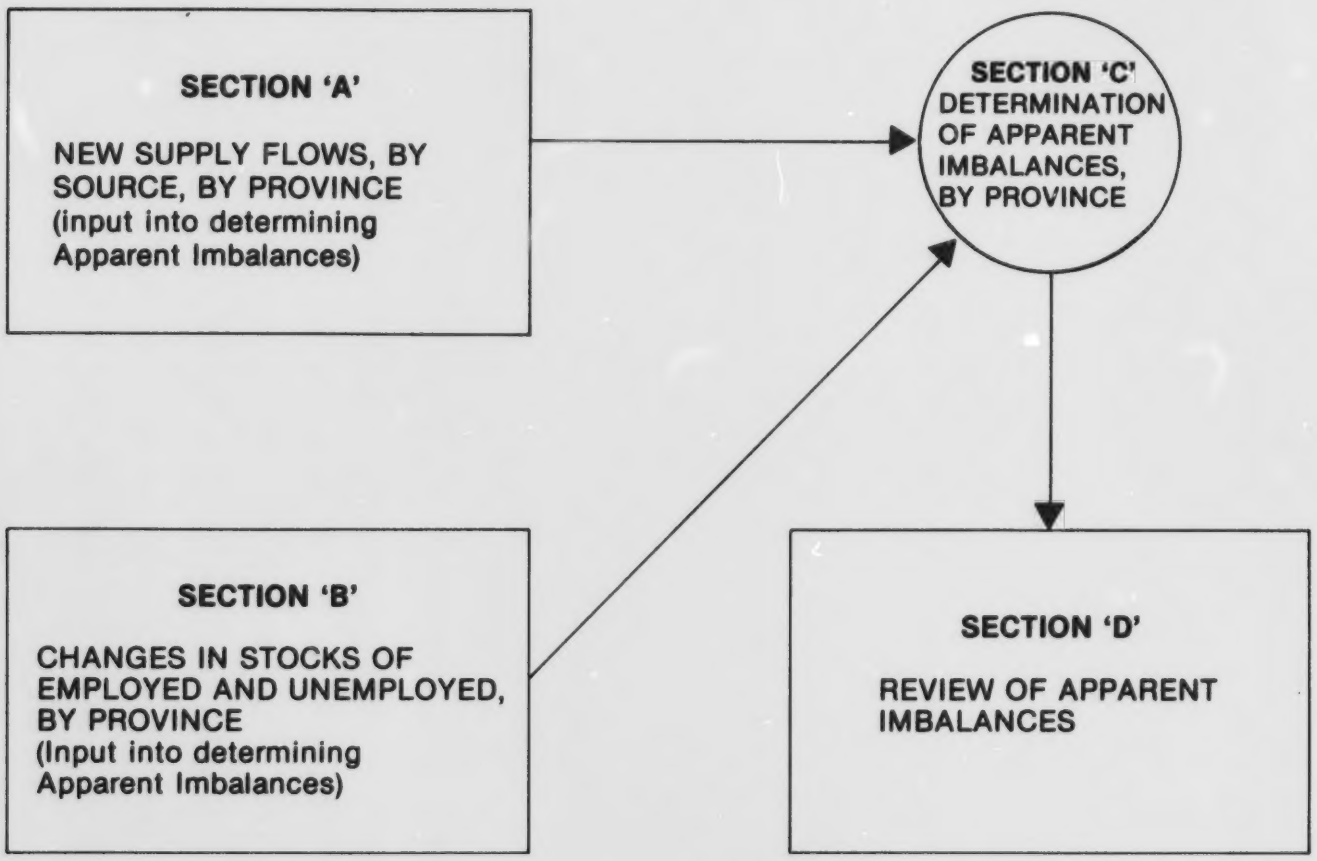
SECTION 'A'
NEW SUPPLY FLOWS, BY SOURCE, BY PROVINCE (input into determining Apparent Imbalances)
SECTION 'C' DETERMINATION OF APPARENT IMBALANCES, BY PROVINCE
SECTION 'B'
CHANGES IN STOCKS OF EMPLOYED AND UNEMPLOYED, BY PROVINCE (Input into determining Apparent Imbalances)
SECTION 'D'
REVIEW OF APPARENT IMBALANCES

DIAGRAM 1

of a year must be considered, along with the flows from education, training, etc., as part of the overall supply of labour in that year. It also means that once labour supply and demand have been compared in a given year, the remaining unemployed must be 'carried over' to constitute part of the labour supply of the next projection year.

Hence, in its broadest terms, the C.O.P.S. supply approach aims to produce a dynamic model in which imbalances in one year influence labour supply and demand in the next. Diagram 3 illustrates how estimates of the unemployed stock are treated from one year to the next, while Diagram 2 follows the new labour supply flows in the current year from individual supply sources such as education, training, etc.

In Diagram 2, population projections influence enrolments and overall provincial labour force size. Enrolments translate into graduates who enter the labour force, armed forces, or households, or emigrate. Subsequent labour force entrants from households or the armed forces are also illustrated. In the top line of the diagram, population influences provincial labour force, which is used to check the "reasonableness" of the estimates of labour supply from individual sources.

At a provincial level, net interprovincial migration

SECTION 'A' — NEW SUPPLY FLOWS, BY PROVINCE

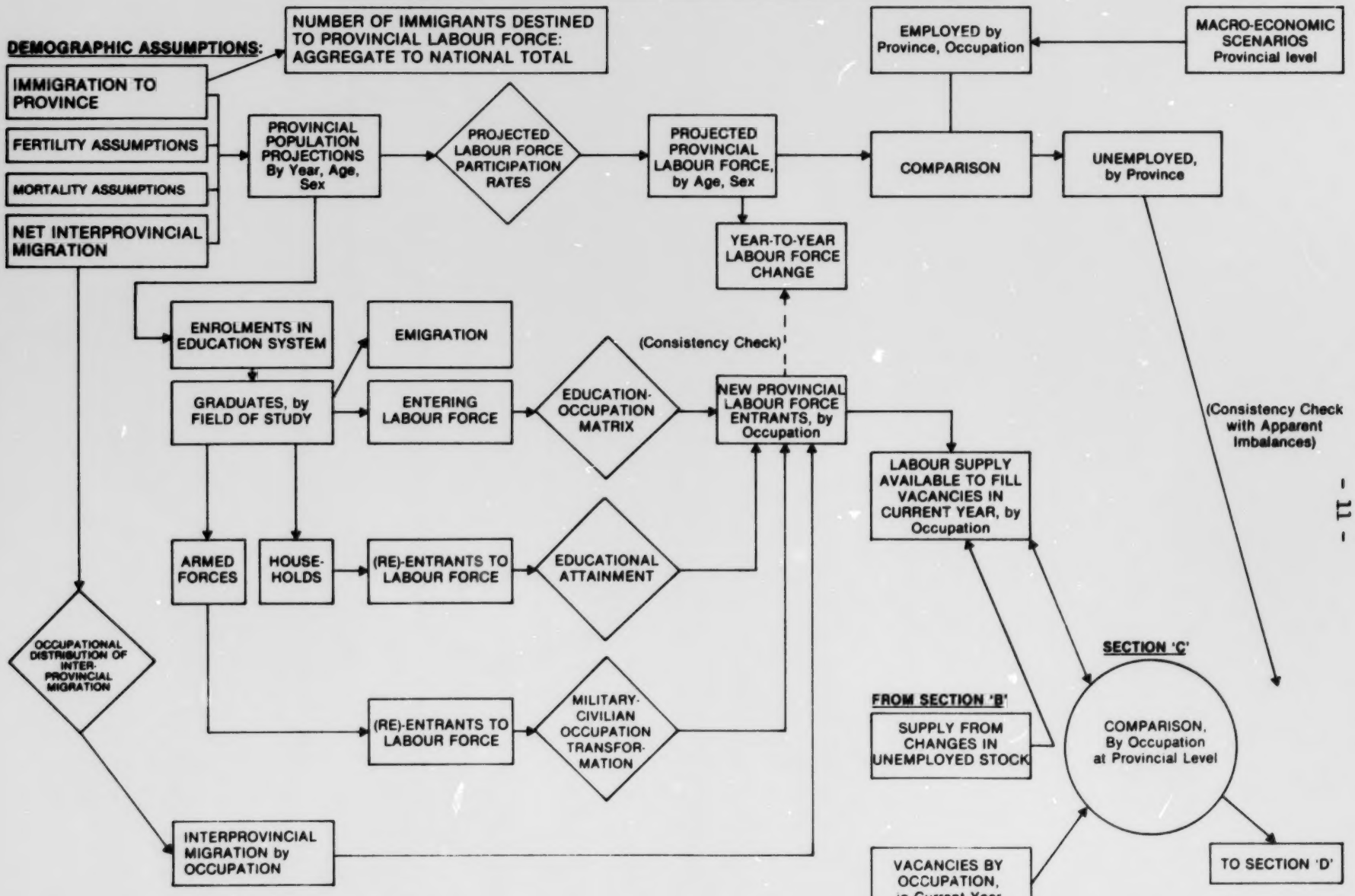
DEMOGRAPHIC ASSUMPTIONS:
IMMIGRATION TO PROVINCE
FERTILITY ASSUMPTIONS
MORTALITY ASSUMPTIONS
NET INTERPROVINCIAL MIGRATION
NUMBER OF IMMIGRANTS DESTINED TO PROVINCIAL LABOUR FORCE: AGGREGATE TO NATIONAL TOTAL
PROVINCIAL POPULATION PROJECTIONS By Year, Age, Sex
PROJECTED LABOUR FORCE PARTICIPATION RATES
PROJECTED PROVINCIAL LABOUR FORCE, by Age, Sex
YEAR-TO-YEAR LABOUR FORCE CHANGE
EMPLOYED by Province, Occupation
MACRO-ECONOMIC SCENARIOS Provincial level
COMPARISON
UNEMPLOYED, by Province
(Consistency Check with Apparent Imbalances)
(Consistency Check)
ENROLMENTS IN EDUCATION SYSTEM
EMIGRATION
GRADUATES, by FIELD OF STUDY
ENTERING LABOUR FORCE
EDUCATION-OCCUPATION MATRIX
NEW PROVINCIAL LABOUR FORCE ENTRANTS, by Occupation
LABOUR SUPPLY AVAILABLE TO FILL VACANCIES IN CURRENT YEAR, by Occupation
ARMED FORCES
HOUSE-HOLDS
(RE)-ENTRANTS TO LABOUR FORCE
EDUCATIONAL ATTAINMENT
OCCUPATIONAL DISTRIBUTION OF INTER-PROVINCIAL MIGRATION
(RE)-ENTRANTS TO LABOUR FORCE
MILITARY-CIVILIAN OCCUPATION TRANSFOR-MATION
SECTION 'C'
FROM SECTION 'B'
SUPPLY FROM CHANGES IN UNEMPLOYED STOCK
COMPARISON, By Occupation at Provincial Level
INTERPROVINCIAL MIGRATION by OCCUPATION
VACANCIES BY OCCUPATION, in Current Year
TO SECTION 'D'

DIAGRAM 2

also constitutes a supply source. Assumptions regarding overall net interprovincial migration influence the provincial population projections, and these same migration projections, broken down by occupation, constitute a component (positive or negative) of provincial labour supply on an occupational basis.

In Diagram 3, stocks of employed and unemployed carried over from the preceding year are subject to attrition, through the effects of death, labour force withdrawal and emigration. Following attrition, the remaining unemployed constitute a part of the labour supply in the current year, while on the demand side, attrition creates new vacancies.

In Diagram 4, labour supply in the current year, from all sources, is compared to current labour demand, by occupation. To the extent that supply and demand do not balance perfectly, this will result in continued unemployment in some occupations and vacancies in others. In principle, these results can be carried over to the next year, although the existence of vacancies may instead prompt immigration policy decisions, as shown.

The individual components of this overall supply framework are now discussed in greater detail, below.

SECTION 'B' — CHANGES IN STOCKS OF EMPLOYED AND UNEMPLOYED, BY PROVINCE

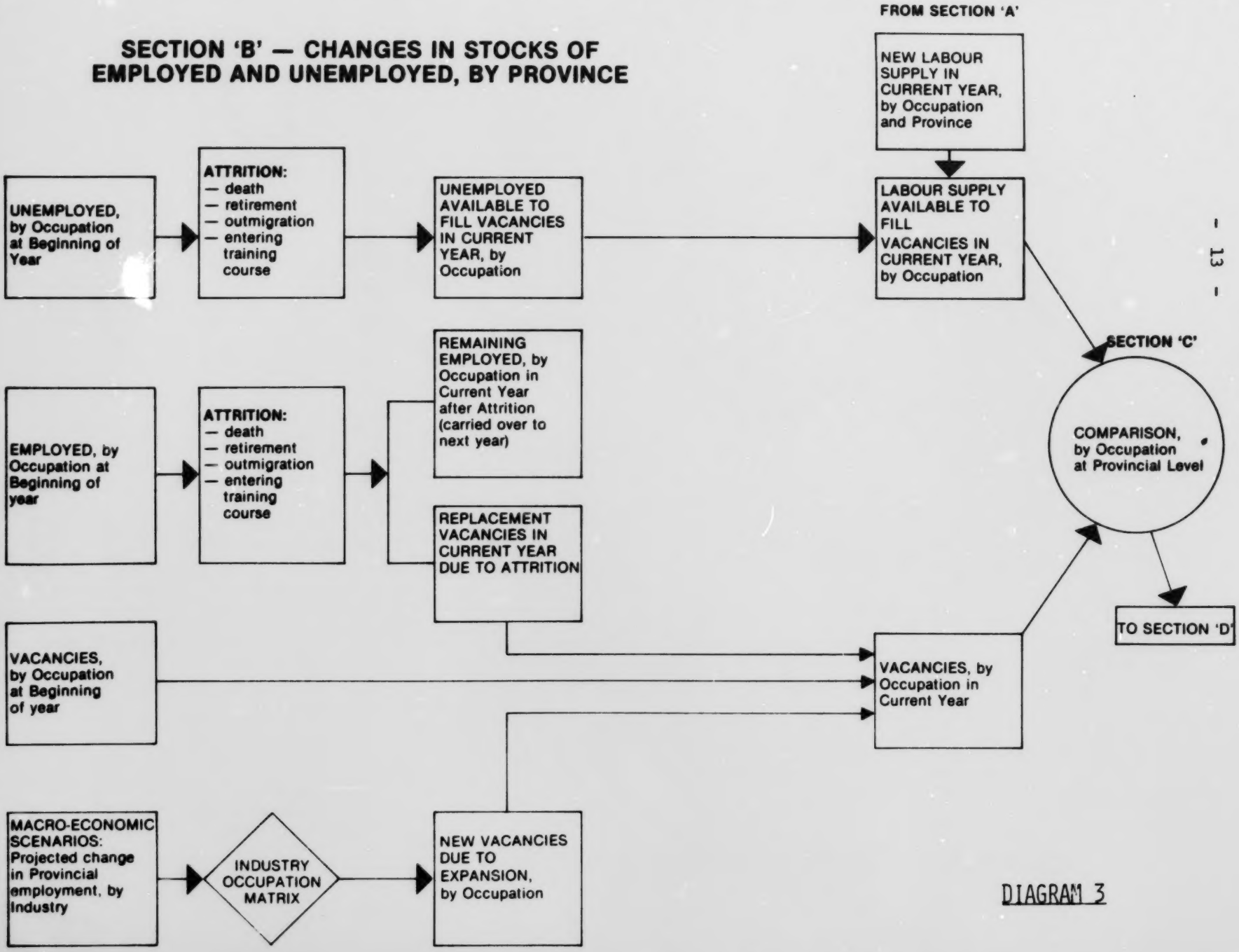
FROM SECTION 'A'
NEW LABOUR SUPPLY IN CURRENT YEAR, by Occupation and Province
UNEMPLOYED, by Occupation at Beginning of Year
ATTRITION:
— death
— retirement
— outmigration
— entering training course
UNEMPLOYED AVAILABLE TO FILL VACANCIES IN CURRENT YEAR, by Occupation
LABOUR SUPPLY AVAILABLE TO FILL VACANCIES IN CURRENT YEAR, by Occupation
SECTION 'C'
EMPLOYED, by Occupation at Beginning of year
ATTRITION:
— death
— retirement
— outmigration
— entering training course
REMAINING EMPLOYED, by Occupation in Current Year after Attrition (carried over to next year)
REPLACEMENT VACANCIES IN CURRENT YEAR DUE TO ATTRITION
COMPARISON, by Occupation at Provincial Level
TO SECTION 'D'
VACANCIES, by Occupation at Beginning of year
VACANCIES, by Occupation in Current Year
MACRO-ECONOMIC SCENARIOS: Projected change in Provincial employment, by Industry
INDUSTRY OCCUPATION MATRIX
NEW VACANCIES DUE TO EXPANSION, by Occupation

DIAGRAM 3

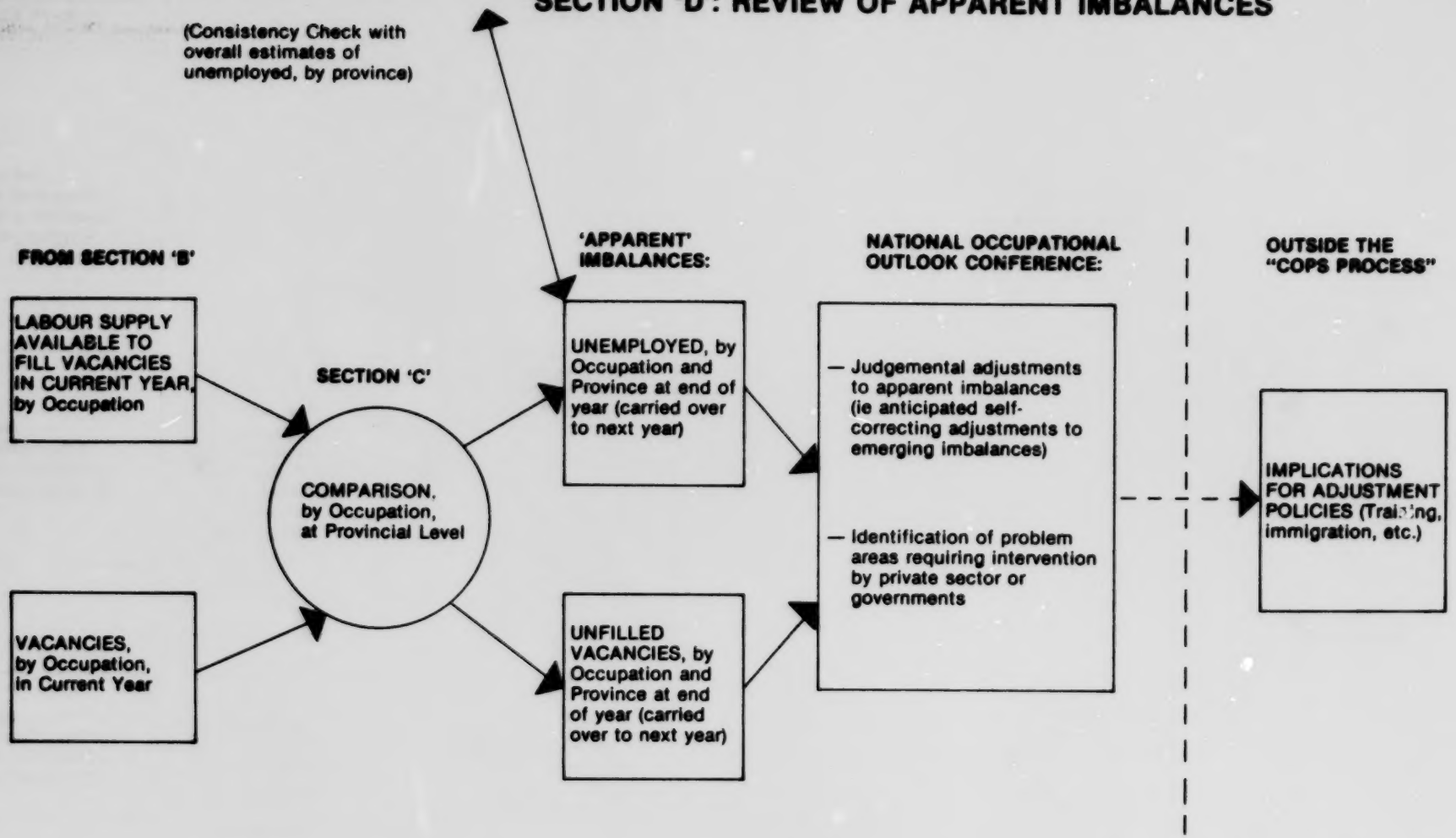
SECTION 'D': REVIEW OF APPARENT IMBALANCES
(Consistency Check with overall estimates of unemployed, by province)
FROM SECTION 'B'
LABOUR SUPPLY AVAILABLE TO FILL VACANCIES IN CURRENT YEAR, by Occupation
VACANCIES, by Occupation, in Current Year
SECTION 'C'
COMPARISON, by Occupation, at Provincial Level
'APPARENT' IMBALANCES:
UNEMPLOYED, by Occupation and Province at end of year (carried over to next year)
UNFILLED VACANCIES, by Occupation and Province at end of year (carried over to next year)
NATIONAL OCCUPATIONAL OUTLOOK CONFERENCE:
— Judgemental adjustments to apparent imbalances (ie anticipated self-correcting adjustments to emerging imbalances)
— Identification of problem areas requiring intervention by private sector or governments
OUTSIDE THE "COPS PROCESS"
IMPLICATIONS FOR ADJUSTMENT POLICIES (Training, immigration, etc.)

DIAGRAM 4

III INDIVIDUAL COMPONENTS OF SUPPLY

a) Population

Ultimately, population dominates labour supply. In the C.O.P.S. supply side system, provincial population projections directly influence labour supply through their effects on aggregate labour force size and enrolments. Through these, the effects of population are implicitly transmitted to other supply components.

However, population also influences aggregate demand and thus, occupational requirements. This simultaneous influence of population on both labour supply and demand means that the assumptions made regarding immigration and interprovincial migration must be clearly understood.

i) Immigration

The population projections required for the demand-side estimates presuppose a projected level of net international immigration. Hence, they imply something about immigration policy during the projection period. On the other hand, it is expected that one of the end uses of the C.O.P.S. projections will be to provide an information base on which immigration policy decisions themselves can be made. The need to assume a projected immigration level on the one hand must be reconciled with the use of C.O.P.S. in immigration decisions themselves, on the other.

To address this apparent inconsistency, C.O.P.S. makes a distinction between the number of immigrants and their occupational composition. It incorporates an assumption about the number of immigrants into its population projections, which are used subsequently in both the demand and supply projections. On the demand side the Canada-level population projections are incorporated directly into estimates of aggregate demand. On the supply side, provincial-level population projections incorporate historical provincial shares of immigration, and influence provincial enrolment, graduation and labour force projections. The overall demand and supply estimates are thus kept consistent; each includes the same assumption about the number of projected immigrants.

Although these estimates include the number of immigrants, however, no assumptions are yet made about their occupational composition. Only after occupational supply from domestic sources has been compared to aggregate occupational requirements to produce estimated provincial imbalances by occupation, is the potential occupational distribution of immigrants considered. At this point, the occupational composition of projected vacancies, at the national level, can be used in immigration policy decisions, to identify the 'required' occupational composition of immigration. To the extent that the number of 'required' immigrants differs from the number assumed in the original population projection, a review of the C.O.P.S. assumptions regarding future immigration policy as

a whole may be necessary. This review may also have implications for the immigration policy itself.

ii) Interprovincial Migration

It can be argued that interprovincial migration can be viewed to a considerable degree as an adjustment to labour market imbalances. This implies that estimates of the amount and occupational composition of interprovincial migration should be derived from projected occupational imbalances, rather than incorporated into them at the start. As with immigration, however, some degree of simultaneity may be involved, i.e. interprovincial migrants influence both occupational requirements and supplies. Projected levels of interprovincial migration are therefore incorporated into the C.O.P.S. provincial population projections. In this way, both the demand and supply projections, each of which incorporates population projections, incorporate projected values for interprovincial migration. These latter migration projections themselves incorporate implicit expectations about provinces' relative economic performances.

Since both the demand and supply projections, in aggregate terms, implicitly include projected interprovincial migration, imbalances derived from comparing demand to supply also do so. The imbalances, in aggregate, must be viewed in this light.

Similarly, the occupational composition of interprovincial migration will also respond in some degree to the occupations in which imbalances are projected to occur. At the moment, however, C.O.P.S. has not developed any basis for estimating the response of migrants to projected shortages, in occupational terms. Such estimations would involve extensive analysis and data.

Rather, as an initial approach, C.O.P.S. would propose to examine historical occupational distributions of interprovincial migrants, and apply these to the projected migration totals which are included in the population projections. The provincial level occupational imbalances which remain after these projected interprovincial migrants' occupations are taken into account will indicate what deviations from past interprovincial mobility patterns would be necessary to minimize future imbalances. In turn, the capacity for such deviations to occur, and hence the possible severity of the remaining imbalances, could be assessed either judgementally or, in the future, on a more rigorous basis.

Clearly, this simplified initial approach can be improved upon to the extent that data and analysis incorporating the "push" and "pull" factors influencing migration, by occupation, can be incorporated.

iii) The C.O.P.S. Population Projection Process

Keeping in mind the specific difficulties noted above,

C.O.P.S. relies on population projections provided by Statistics Canada. These projections are 'special' because they are produced as an integral part of the C.O.P.S. process, exclusively for the C.O.P.S. labour supply projections. The population projections are based on assumptions regarding the key demographic variables, i.e. immigration, net interprovincial migration, and fertility and mortality rates.

Projected immigration levels are provided by C.E.I.C. and agreed to by provincial governments; assumptions regarding the other demographic variables are provided at the provincial level by provincial governments in consultation with C.E.I.C. regional economists. In the event that provinces' assumptions do not produce a consistent national picture,[1] then:

a) they are reconciled for national consistency, and

b) two sets of population projections are produced for each province — one using the nationally consistent assumptions and one using that province's own preferred set of assumptions.

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[1] This will tend to occur primarily when provinces' individual estimates of net interprovincial migration are not consistent at the national level (i.e. they do not sum to zero) or where provinces' estimated share of immigration do not add to a consistent national total.

Both sets of population projections are mounted on the C.O.P.S. supply system, and can be interchanged, for maximum user flexibility. The population projections are produced, at the provincial level, by sex and five-year age groups. Only the projections based on the nationally consistent demographic assumptions are summed to give a Canada total.

b) The Education System - Enrolments and Graduations

i) Introduction

The education system is the major source of new manpower. It not only determines their quality, but also contributes to their productivity and adaptability. The development of a means to project school-leavers available to the labour force, by province, level, and field of study, has therefore formed the "core" of the C.O.P.S. supply side activity. This section outlines the approach C.O.P.S. has adopted to make these projections as well as the large number of conceptual, methodological and data problems involved.

Many of the main features of the C.O.P.S. "Student Flow" model have been based on the leading work done in this area since 1972 by Statistics Canada.[1] A number of other considerations, however, have led the C.O.P.S. approach to depart from those of Statistics Canada. In the first place, it was felt important that C.O.P.S. develop an initial methodology fairly quickly. This could be used in large measure as a focus for discussion and improvement, and could, when integrated with other supply side components, illustrate an overall C.O.P.S. approach to projecting the flow from the education system to the labour market, by occupation.

[1] This includes, for example, Z. Zsigmond and E. Rechnitzer, Projected Potential Labour Force Entrants from the Canadian Educational Systems, 1971-85, Statistics Canada, and Z. Zsigmond, G. Picot, M.S. Devereaux and W. Clark, Future Trends in Enrolment and Manpower Supply in Ontario. Statistics Canada

Second, it was essential that supply projections be available at a provincial level. This meant that, as a start, an approach be adopted which could use data available on a consistent basis for all provinces. Means of tailoring projections to individual provinces' unique data sets could be explored over time.

Third, since population and enrolment projections figure in both the demand and supply 'sides' of the projection process, it was essential that C.O.P.S. ensure that the timing of its development of population and enrolment projections was appropriate to the needs of the demand side macroeconomic model. Relatively rapid development of a functional enrolment projection approach was thus required.

ii) Methodology

The enrolment and school-leaver projections are based initially on population projections, by age/sex group and province. The assumptions and process by which population projections have been developed for C.O.P.S. purposes have been described above, and are not repeated here. Discussion of the Student Flow methodology therefore begins with enrolments.

Enrolments

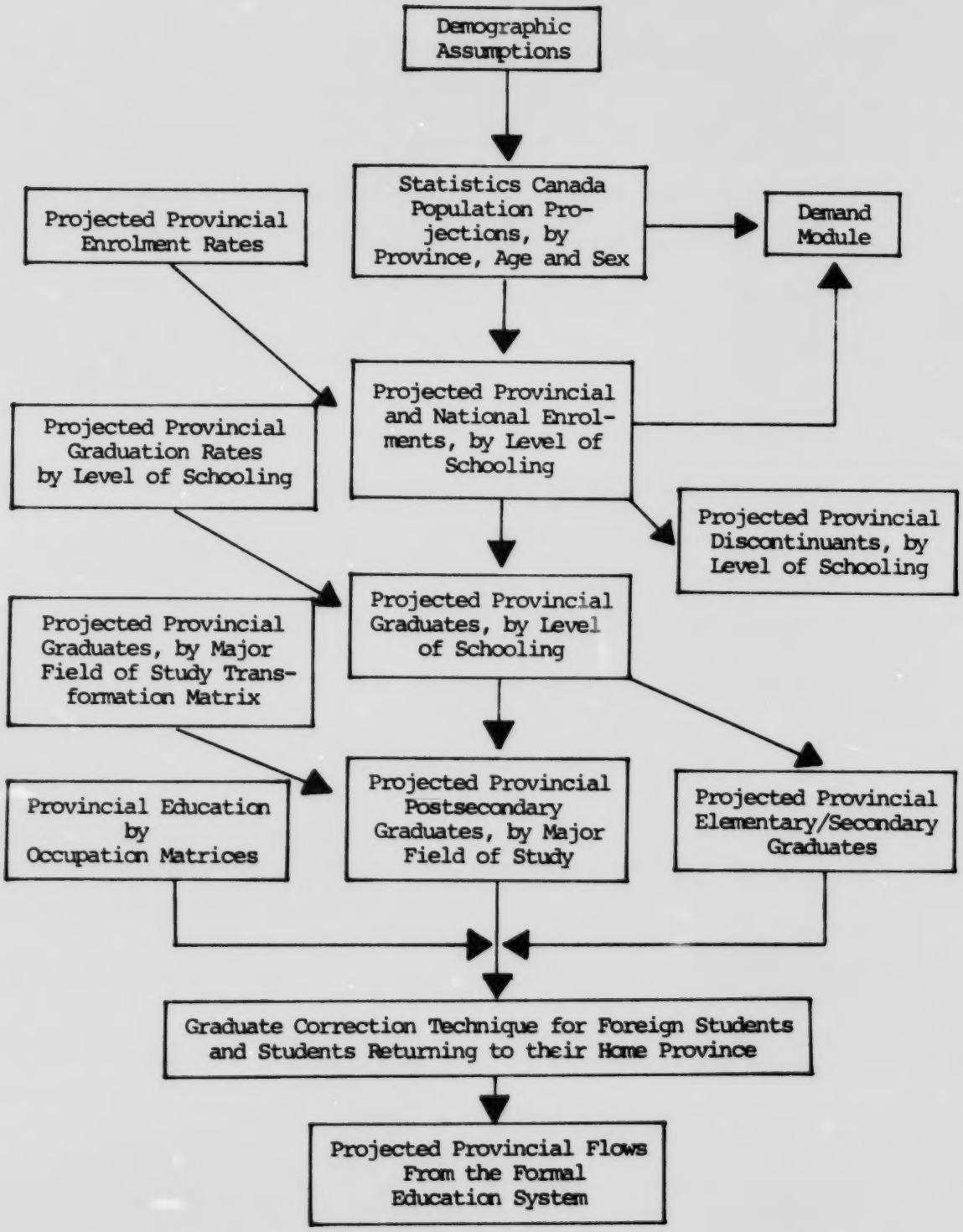
Before the future output of the educational system (school-leavers) can be calculated, it is necessary to project the

input to the system (enrolments). For purposes of consistency with the Demand module, C.O.P.S. adopted as its basic education breakdown the six levels of schooling which are contained in the C.O.P.S./ Informetrica macroeconomic model. Enrolments in each schooling level would be projected by applying enrolment rates (either historical or altered to reflect circumstances) to projected populations in the 'relevant' age group. These schooling levels and the corresponding relevant 5-year age groupings, to which the enrolments have been related (via enrolment rates), appear in Table 1. It is appreciated that in some instances these age groupings may be too wide (as in the case of elementary/secondary or too narrow (as in the case of university), to reflect sensitively the demographic influences on enrolment. However, consistency with the macroeconomic model provided the constraint. In any case, plans are under way to review the appropriateness of these age groups as determinants of enrolments.

TABLE 1

RELEVANT LEVEL OF SCHOOLING	RELEVANT 5-YEAR AGE GROUPING
Total Elementary/Secondary Enrolment	Ages 5 to 19
Total Postsecondary Non-university Enrolment	" 15 " 24
Male Postsecondary University Undergraduate Enrolment	" 17 " 21 (males)
Female Postsecondary University Undergraduate Enrolment	" 17 " 21 (females)
Male Postsecondary University Graduate Enrolment	" 22 " 26 (males)
Female Postsecondary University Graduate Enrolment	" 22 " 26 (females)

CHART 1


Demographic Assumptions
Statistics Canada Population Projections, by Province, Age and Sex
Demand Module
Projected Provincial Enrolment Rates
Projected Provincial and National Enrolments, by Level of Schooling
Projected Provincial Graduation Rates by Level of Schooling
Projected Provincial Discontinuants, by Level of Schooling
Projected Provincial Graduates, by Level of Schooling
Projected Provincial Graduates, by Major Field of Study Transformation Matrix
Projected Provincial Postsecondary Graduates, by Major Field of Study
Projected Provincial Elementary/Secondary Graduates
Provincial Education by Occupation Matrices
Graduate Correction Technique for Foreign Students and Students Returning to their Home Province
Projected Provincial Flows From the Formal Education System

Since the Informetrica macroeconomic model contains only population projections by 5-year age groups ending in 4 or 9 (e.g. 10-14, 15-19 etc.) the historical university enrolment rates were calculated as the specific enrolment in year t as a proportion of the relevant 5-year age grouping in year t-2.

To project enrolments, information was solicited from provincial governments on the province's anticipated enrolment rates for the above six educational levels over the period to 1990. Where a province responded with enrolment numbers rather than rates, the numbers were used in their raw form. For provinces where no data was provided, enrolment rates were imputed, assuming close (positive) relationship between enrolments rates and the tightness of the labour market.[1]

The projected enrolment rates, when applied against the relevant projected population, yielded estimates of enrolments to the year 1990, which at the national level were in turn fed into

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[1] More specifically, it was assumed that a continued tight labour market would increase job competition to the extent that the post-secondary non-university (career oriented) enrolment rates would increase relative to the university enrolment rates; and that female enrolment rates would rise faster than those of males, resulting in approximately a 50 percent share of post-secondary enrolment by the late 1980s. With (youth) unemployment beginning to grow quite rapidly in 1981, peaking in 1982 and descending slowly thereafter, enrolment rates were assumed to rise marginally above the 1980 level in 1981, substantially rise again in 1982 and then slowly return to their 1980 level by 1984. The rates for the 1985-1990 period were based upon the 1975-1980 provincial trends.

the macro model. It must be stressed that these enrolment rate assumptions may be altered on the C.O.P.S. system by users as they feel appropriate.

It was felt that the flow of school-leavers to specific occupations would vary not only by the leavers' field of specialization but also according to the specific level within each of the post-secondary non-university, undergraduate university and graduate university levels. For example, it seemed that the labour market port-of-entry would differ if a student received a Bachelors degree in English Literature than if he received a Doctorate in the same field. To this end the above three broad categories were further disaggregated (Table 2), on the basis of the recent (i.e. 1980) historical distributions of the more detailed breakdowns. These more detailed enrolments serve as a crucial link in the development of the corresponding projections of graduation rates and graduates.

iii) School-leavers

Leavers from the educational system can be those students who leave upon receiving a qualification as well as those who leave without receiving a qualification. These two components will be discussed in turn.

a) Graduates

Thus far, the methodology has involved projected age/sex specific enrolment rates applied against relevant population

TABLE 2

Detailed Enrolment Breakouts

Major Education Level	Minor Education Level
1. Post-secondary Non-University	Community College Career Programs
	Community College University Transfer Programs
	Schools of Nursing[1]
	Teachers Colleges[1]
2. Post-secondary Undergradute University	Bachelors and First Professional Degree
	Undergraduate Diplomas and Certificates
	Other Undergraduate[2]
3. Post-secondary Graduate University	Master Degree
	Doctorates
	Graduate Diplomas and Certificates
	Other Graduate[3]

[1] A suggestion has been made by Z. Zsigmond (Statistics Canada) that these two minor levels could be safely blended into the Community College Career Program

[2] Consists of preliminary year, upgrading year, special auditors, all other students taking undergraduate courses not for the purpose of obtaining a qualification, non-university type courses and interns

[3] Consists of Masters qualifying, special auditors at the graduate level, residents and all others taking graduate courses not for the purpose of obtaining a qualification

projections to yield projections of enrolments by educational level. Graduation rates, when applied against these enrolments, will produce projections of graduates by educational level.

However, it did not follow that the most appropriate way to derive graduation rates was to relate current graduates to current enrolments. Rather, relating current graduations to enrolments a few years earlier (i.e. when those currently graduating first enrolled) provided a more stable graduation rate. The graduation year and the relevant enrolment year from which graduation rates are derived, appear in Table 3, for each education level. An examination of the graduation rates in the recent past found them to be quite stable, especially over the 1978 to 1980 period. Based on this observation, the 1980 education-specific graduation rates were used to derive estimates of graduates over the period 1981-1990.

The next step was to break down these graduates by field of study. The University Student Information System (USIS) and Community College Student Information System (CCSIS) were utilized to derive the historical distributions of graduates by field of study, within each educational level. These proportions were examined over the 1971-1980 period, and were found to indicate a shift away from liberal arts to career oriented courses. Although it was felt that this shift will probably continue, due to increased

TABLE 3

Graduation Rates

Education Level	Graduation Year (1)	Enrolment Year (2)	Graduation Rate for Year (1)÷(2)
1. Elementary/Secondary	t	t-12	t
2. Post-secondary Non-university			
Community College Career Program	t	t-2	t
University Transfer Program[1]	-	-	-
Nursing Schools	t	t-2	t
Teachers College	t	t-2	t
3. Post-secondary Undergraduate University			
Bachelors and First Professional Degree	t	t-3	t
Diploma and Certificates	t	t-2	t
Other[2]	-	-	-
4. Post-secondary Graduate University			
Masters	t	t-1	t
Doctorates	t	t-2	t
Diploma and Certificates[3]	t	t-1	t
Other[2]	-	-	-

[1] The only consistent historical data available for this group was enrolment, thus graduation rates could not be calculated. It is assumed that the graduates who continue their education will be caught in the province education level specific enrolment rates. In 1980 only four provinces offered University Transfer Programs; Nova Scotia (177), Quebec (68,316), Alberta (2,424) and British Columbia (7,472).

[2] No graduate data were available for these categories and thus graduate projections were not made.

[3] Zsigmond (Statistics Canada) has suggested that graduates from this category should be ignored since, by definition, each student in this category already has a degree and if included in graduate projections could result in serious double counting.

job competition, no attempt was made to build these possible trends into the model at this stage. Rather, the 1980 proportions were utilized over the projection period. It should be noted, however, that the model permits users to substitute their own projected proportions, if they wish.

To produce estimates of the number of graduates potentially available to the provincial labour force, two adjustments were required. First, the 1980 proportion of foreign student graduates to total graduates, by level and field, was applied to the corresponding projected total graduates. These graduates were then subtracted from total graduates since, by law, they must return home, or at least leave the country temporarily, and thus are not potentially available to the Canadian labour force.

The second correction involves students graduation from a university in one province but whose primary residence is in another. It is assumed that these students will return home upon graduation, and that they will not enter the labour force of their province of graduation. A procedure similar to that for foreign students was followed to "cleanse" the graduation data by sending the graduates back to their home labour force.

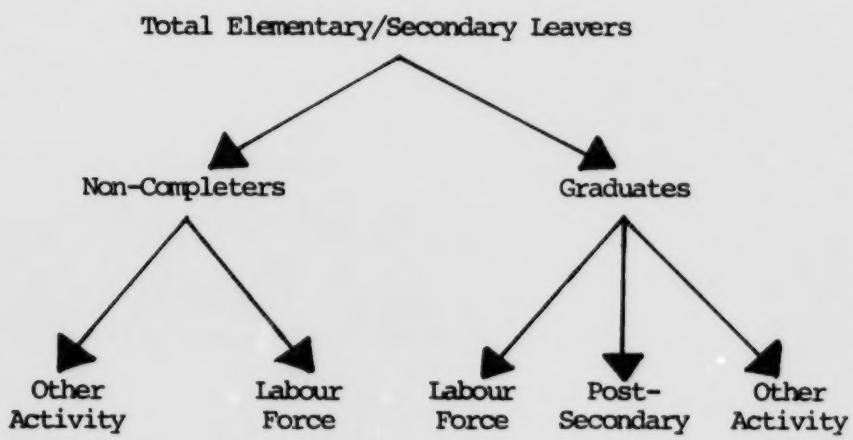
b) Non-completers or Discontinuants

The second major outflow from the education system is that of students who leave the system without receiving a degree,

diploma or certificate. Since these data are not collected, an alternate methodology[1] had to be derived.

The method chosen by C.O.P.S. to calculate discontinuants varies according to the specific educational level. At the elementary/secondary level the Zsigmond procedure for calculating total elementary/secondary leavers was repeated for the 1971-1980 period, at a provincial level. The possible alternatives for elementary/secondary leavers are depicted in Chart 2.

CHART 2



[1] The methodology utilized by Zsigmond et al, while not overly complex, involves the separate projection of a large number of variables. Despite its obvious merits such an approach was seen as lying outside the time-frame of the present C.O.P.S. exercise.

For the historical period, total elementary/secondary school-leavers were taken as a proportion of the corresponding years' total elementary/secondary enrolment. This, when applied against projected enrolments, yielded projections of total elementary/secondary leavers. The historical proportion of elementary/secondary leavers who continue directly to post-secondary education was also calculated. This when applied against projected total elementary/secondary leavers, produced projections of students continuing their education. The remaining leavers (55 to 60 percent of the total), were then assigned the youth labour force participation rate from the macroeconomic scenario to yield an estimate of new entrants to the labour force from the elementary/secondary system.

The method utilized to calculate non-completers at the post-secondary level was less complex. Historically, the graduates from a specific level of education were subtracted from the relevant first year enrolments in year t-X, where X represents the assumed time taken to complete course requirements (see Table 3). This number was then taken as a proportion of total enrolments in year t, which when applied (using the 1980 proportion) against projected estimates of enrolments yields projected non-completers by province and post-secondary level of education. The labour force participation rate of discontinuants is assumed to be the same as

that of graduates, as determined by graduate follow-up surveys.[1] Discontinuants from a given level of post-secondary education are assumed to possess the qualifications of the next lowest level of education.

The above procedures produce projections of graduates, by province, level, and field of study, and of discontinuants, by province and level, available to the provincial labour force. (The discontinuants can be shared among field of study using simplifying historical assumptions.) These estimated "labour force-ready" school-leavers can then be allocated by occupation, using data relating field of study to occupation, described in the next section.

It must be stressed that the C.O.P.S. exercise is a long-term projection, and thus its purpose is indicative rather than prognostic. Most of the projections, on the supply side especially, and in the educational sector in particular, are based on past trends or some modification of these. Thus the projections will indicate "If past trends continue or change in given ways, this is what one can expect to happen".

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[1] These data were derived from the findings of the 1978 national survey of 1976 university and college graduates

c) The Education-Occupation Transformation

i) Introduction

Critical to the estimation of occupational imbalances will be the ability to rely on data which give an acceptably detailed picture of the relationship between education (field of study) and occupation. Since school-leavers move from fields of study to occupations, a means must be developed for relating the two, if the transition to the labour market is to be effectively estimated. This is particularly the case for highly qualified occupations, in many of which there is not a clear relationship of this type.

At the highly qualified and technical semi-professional levels, however, there are two possible ways of expressing the education-occupation relationship, and the choice between them will be influenced by data detail and availability, by conceptual questions, and by views on how the expression of imbalances will be most useful for policy purposes. Briefly, the choice is between an approach which will transform occupational requirements data into corresponding educational requirements, and one which will transform educational supply data into occupational supply terms. In the former, the resultant imbalances are expressed in educational terms; in the latter, in occupational terms.

Each of the approaches is useful for a given set of circumstances. C.O.P.S. has examined each of them to assess their relative usefulness in the development of its projected occupational imbalances.

ii) The Occupation-to-Education Transformation

At the highly qualified manpower (HQM) and technical/semi-professional (TSP) levels, the occupation-to-education transfonnation offers a conceptually viable approach. Expressing imbalances in educational terms may be quite reasonable since many actions to eliminate these imbalances may best be expressed in educational terms.

Transforming occupation into education effectively incorporates data for the entire population in that occupation. It can be argued, as a result, that a transformation of this kind implicitly incorporates the effects of interoccupational mobility and may give a more realistic picture of the range of education fields which contribute to supply in a given occupation. On the other hand, this range of educational supply sources is a historical one, and may not reflect the educational range relevant to future supply in that occupation. Furthermore, it is not possible to tell which occupations have contributed, through interoccupational movement, to past supplies in a given occupation. This

last point may be of great importance since certain occupations may in themselves serve as training grounds for others.

Due to the types of populations considered in the occupation-to-education transformation (namely all individuals within the given occupations), this approach has to rely on data where the universe is made up of all individuals in the occupations considered, and for whom a trace-back to their educational background (fields of study) can be made. Such data can be obtained by using detailed surveys, census, or administrative data. Because of the amount and nature of the information they require, the first two may prove very expensive and somewhat less accurate, whereas the third involves collection of additional information by various government departments and the merging of that information.

iii) The Education-to-Occupation Transformation

The education-to-occupation transformation offers a viable approach as well. Within the context of an overall model of occupational supply, it provides the educational component of supply, by estimating the occupations in which those leaving individual fields of study may go. When focussing on supply in an occupation, it is important that an assessment be made of the adequacy of the most direct sources of new supply for that occupation. These are likely to be those courses whose graduates enter more or less immediately into the occupation in question. In this case,

the education/first occupation transformation may prove most relevant in helping determine whether the amount or composition of the output of the education system should be changed to make it more immediately appropriate to projected occupational requirements.

The data requirements for this approach are considerable, but somewhat more modest than for the opposite approach. Here, the universe is that of graduates/discontinuants from the education system, and the information relates to their activities (and in particular, their occupations) more or less immediately upon graduation. These data may be obtained using administrative data, surveys of graduates, or population censuses.

iv) Selection of Approach for C.O.P.S.

From the above discussion, it is clear that both the approaches examined are useful for certain types of analysis. However, in order to use limited time and resources most efficiently, it is preferable to allocate a higher priority to the one that appears to serve C.O.P.S. needs best. Following discussions present several important considerations which lend support to the use of the education-occupation transformation, i.e. the capacity to review school-leavers by field of study to determine which occupations they enter.

A first consideration reflects the fact that the C.O.P.S. information framework is intended for use in identifying needed labour market adjustments. These adjustments can take a variety of forms, including changes in training/education patterns, inter-provincial or international migration, or interoccupational mobility. To translate occupational requirements into educational terms would either assume implicitly that education is the only supply channel capable of contributing to adjustments, or would introduce an inconsistent terminology to account for the other sources of supply. Since education change is only one of a number of potential adjustments to labour market imbalances, it would appear most appropriate to express these in standard occupational rather than educational terms. In short, it is important to keep in mind that what is involved is labour force adjustment, not simply educational adjustment.

It should therefore be emphasized — and estimating imbalances on an occupational rather than an educational basis serves to do so — that C.O.P.S. estimates are not exclusively a basis for training/education decisions. Their use is much broader than that, and the form of their estimates must reflect that breadth. This point argues strongly that emphasis should initially be placed on transforming school-leavers' fields of study into occupational terms, rather than vice versa.

A second consideration is much more practical. Development of the capacity to relate occupations back to the education of their members will require an extensive coverage of occupations, as well as related fields of study. The 1971 Census, augmented by the 1973 post-censal survey of highly qualified manpower, provided the capacity to produce such a transformation, for university graduates. However, similar capacity is not expected of the 1981 Census. Specifically, the Census itself will not produce data on field of study, while a post-censal survey covering enough educational levels to be of use for C.O.P.S. is not planned.

In short, it is not expected that data sources will in the foreseeable future be available which could be used in transforming a broad array of highly qualified and high- to medium-skilled occupations into the fields of study of their incumbents.

On the other hand, a number of relatively recent data sources exist for use in an education-to-occupation transformation. These include the 1978 national survey of 1976 university and college graduates and other similar surveys conducted by several provinces. Furthermore, such additional data sources can be more readily developed for this than for the other transformation.

On both conceptual and practical grounds, therefore, the case for concentrating on the development of an education-to-

occupation transformation would appear strong. Selection of this transformation has a number of implications, discussed below.

v) Implications of Transforming Field of Study to Occupation

The field of study-to-occupation transformation of course suffers a number of significant problems of its own. Efforts to minimize the effects of these imply further data gathering requirements.

In the first place, the array of observed occupations into which school-leavers enter is probably affected by cyclical and structural factors which influence the occupational composition of labour demand in the short-term. Thus, education-occupation transformations based on these may not reflect the actual long-term patterns of occupational demand, and can lead to inaccurate conclusions and projections. To counter this difficulty, it will be necessary to have available data for a number of years, so that the stability of education-occupation transitions can be followed and the structural influences on these assessed.

Just as serious is the problem that most surveys of school-leavers record only one occupation per individual, for a job obtained shortly after leaving school. Thus, they do not gather data on individuals' subsequent interoccupational flows — a difficulty which can take two forms.

First, a number of these initial occupations are likely to constitute "ports of entry" into career job ladders, up which the individual may be expected to climb over time. New requirements in any of the occupations on a career ladder, if generally met through upward interoccupational mobility, may thus be expected to translate into requirements for the port of entry occupation. Therefore, in comparing occupational requirements to supply, and in determining the adequacy of supply at the port of entry job, it is necessary to include an assessment of requirements in all occupations on the career ladder. To do this, however, requires systematic knowledge of occupations linked via career job ladders. Efforts have to be made to assemble this fuller information set.

Second, and in parallel fashion, it is necessary to identify those occupations which are characterized by lateral interoccupational mobility (i.e. not necessarily part of a career job ladder). Information on these would be needed to permit a better comparison of occupational requirements to the relevant occupational supplies.

In summary, use of a field of study/first occupation transformation would place a premium on the identification of further information on interoccupational mobility, if occupational supply and requirements estimates are to be effectively compared.

The need for further data of this type adds to the practical question of what data are or could be available in the long-term for use in transforming field of study into occupation. Some of the data questions related to education-to-occupation transformation are briefly discussed below. The approach actually adopted by the C.O.P.S. model, and its treatment of some of these data issues, is outlined below.

vi) The Education-to-Occupation Transformation Component of the C.O.P.S. Supply Model

Given the conceptual and data related issues discussed above, C.O.P.S. has sought to develop occupational supply projections from the educational system within the framework of the overall supply projection model. In order to do so, it has recognized the importance of defining the part of the population to be processed by that component, of maintaining assumptions consistent with those of other parts, and of ensuring that projections are expressed in terms which fit within the context of the overall model and its objectives.

The education-occupation transformation is effected through a matrix of expected flows of school-leavers from various fields into various occupations. At the source of the flows, therefore, are categories of full-time university and community college leavers (potential labour force participants) detailed by

their province, their level and field of study. The destination categories are occupations, by "4-digit" level, and province. The expected flows are represented quantitatively as the probabilities of moving from given levels and fields of study to the various occupations.

Although labelled an "Education-to-Occupation" transformation, this portion of the supply framework also serves to estimate the number of school-leavers from the various fields who are not potentially available to the labour force. These would include those entering the household, the Armed Forces or other institutions, or those leaving the country. (These adjustments, of course, have to be reconciled with estimates of the flows to and from other sectors, obtained elsewhere within the supply framework.)

After these adjustments are made, the education-occupation matrix is applied to the numbers of graduates/discontinuants who are expected to be potentially available to the labour force. These are grouped according to their level and field of study, and by their home province. The result is a potential supply of graduates/dropouts by occupation which incorporates the education-occupation relationships of the period in which the data for the matrix were originally gathered.

The population to which the education-to-occupation transformation applies is a subset of students leaving full-time studies in Canadian universities and colleges in 1976. No data are included on vocational and private institutions. It must of course be noted that some of these individuals may already be members of the labour force prior to leaving the education system. Care must therefore be taken to distinguish between these school-leavers' impact in the occupational distribution of the labour force and their impact on the size of the labour force itself. The former may be much more significant than the latter, since it can probably be assumed that students who were labour force members while at school enter a higher-skilled or qualified occupation after graduation than they pursued as students.

Similarly, for this part of the model only school-leavers who were full-time students at the time they left school are considered. This reflects uncertainty about the occupational impact of part-time leavers' studies, and about their motives for pursuing these studies (whether out of interest, or to upgrade qualifications within a given occupation, etc.).

It is also quite clear that many factors affect the flows of individuals from fields of study to occupations. These range from existing economic conditions to the personal preferences of

school-leavers and employers. However, until more experience, data and results or research become available, some simplifying assumptions are necessary. Generally, in the short-term it is assumed that level, field of study and province provide a reasonable basis for a gross grouping of school-leavers in order to assess their subsequent labour force status and, where applicable, their occupational destinations. In the future, these will at first be supplemented with "theoretical" views of the 'ideal' field of study - occupation relationships. Then, as more school-leaver follow-up data become available, the transformation mechanism will be expanded to include more observations over time (and varying economic conditions). This will provide an opportunity to assess the stability of the field-occupation links under various circumstances, as well as better estimates - more reflective of other behavioural and socio-economic factors. It will also permit the introduction of new fields of study, occupations, and flow patterns into the data base.

For the present exercise, the flows from field of study to occupation are derived from the one-point-in-time 1978 National Survey of 1976 Graduates. In time, however, this will be expanded to include data and expertise accumulated by individuals and organizations within and outside the federal and provincial governments. Moreover, it is hoped that additional surveys and administrative

data may be developed in a number of provinces to round out the national level data series necessary to understand and simulate school-leavers' early labour market experiences.

In the current approach, those entering the labour force direct from secondary school have not been distributed by occupation, but have been assumed to enter the unspecified "General Labour" occupations excluded from initial C.O.P.S. study. It is likely, however, that some secondary schools do offer courses which may lead directly to higher skill occupations. This issue remains to be addressed in the future.

Finally, graduates of teachers' colleges and nursing institutions are assumed to enter their intended occupations. Although it is expected that its impact on accuracy of results should not be great, this simplifying assumption will be examined in detail in the future.

d) Apprenticeship

Apprenticeship is the principal domestic supply source for many of the key blue collar trades reported to have been in shortage in the late 1970s. The importance of these occupations, the potential volatility of occupational supply through apprenticeship, and the employment generating potential of one of the major sectors dependent on apprenticeship -- construction -- all make it essential that the apprenticeship be formally and thoroughly addressed within the C.O.P.S. supply framework. In addition, there is a comprehensive body of apprenticeship data which provides substantial potential for thorough analysis, and some early work already exists in developing simple apprenticeship projections.

The conceptual, data, and methodological issues relating to apprenticeship are too complex to be addressed satisfactorily as part of an overview paper. Accordingly, C.O.P.S. is in the process of preparing a complete technical discussion of the subject, which provides details on the apprenticeship model to be proposed within the overall C.O.P.S. framework.

This discussion paper is to be ready in February 1983. Following pages outline the major issues on which the more in-depth discussion will focus, as well as the overall approach C.O.P.S. proposes to adopt in this area.

Apprentices are employees in the trade as well as trainees in a formalized on-the-job training process. Apprentices produce as well as learn. This dual nature of the apprentice is the basis of numerous conceptual problems that must be resolved.

In the first place, the dual nature raises the issue of whether the best indicator of new entry into the trade is apprenticeship completions or new apprenticeship registrations. If new registrations are the best measure in this respect (which might seem reasonable, since apprentices are employed in the trade), this raises the basic question whether information on subsequent flows through apprenticeship is of any use at all. However, if the apprenticeship model is to incorporate projections of the stock of journeymen, projections of apprenticeship completions are absolutely essential.

The factors, economic and otherwise, which influence the proportion of new apprentices who eventually complete their training, are very volatile. In addition, increasing numbers of apprentices receive credit for other training taken which shortens their effective apprenticeship period. The relationship between the number of new apprentices in one year and the number of apprentice completions four years later is therefore a complicated one, but nevertheless a relationship critical to the process of projecting occupational supply in the trades on an annual basis. In the C.O.P.S. view, an apprenticeship model, to be useful, must take this relationship into account.

The approach of attempting to project apprentice completions leads to further significant conceptual and data issues. Trades definitions vary by province, and must be reconciled within the "4-digit" SOC occupational classification framework used by C.O.P.S. Within these categories, moreover, apprentices cannot be distinguished from journeymen, while the categories themselves (particularly in the construction trades) contain many individuals who are neither certified journeymen nor apprentices. In short, there is an underlying need to develop the best possible estimates of the 'stocks' of individuals employed in these trades occupations, even if this involves counts of some components and estimates of others.

At the same time it must be recognized that in some jurisdictions significant numbers of community college graduates become apprentices (often with credit given for their college courses). Within the overall C.O.P.S. supply estimates, therefore potential double counting from sources such as this must be avoided. In this regard, it is also critical that major differences in provincial apprenticeship systems — in particular that of Quebec — be accounted for in the overall C.O.P.S. approach.

Very important to the C.O.P.S. approach in this area will be the determination of the extent to which the apprenticeship model incorporates the institutional and other "training capacity" constraints which limit the number of apprentices the system can absorb at any time, and hence the number of trained journeymen the system can supply. It will have to be recognized, for example, that even stipulated apprentice-journeymen ratios probably overstate the capacity of the system to produce journeymen; practical considerations lower the 'effective' apprentice-journeymen ratio, while changes in this ratio at times of layoff may lower it further. The 'capacity' of the system correspondingly reduced in these ways, must form one element of the C.O.P.S. analysis in this respect.

Finally, regardless of the approach taken in this regard, there will have to be as comprehensive as possible an analysis of the factors affecting the number of new apprentice registrations themselves. The variety of employment related factors which can affect these must be recognized, together with the considerable difficulty of gathering data on these explanatory influences.

Reflecting the importance of the apprenticeship area, together with the significant problems involved in addressing it, C.O.P.S. proposes to begin to develop a model which will project apprentice completions, taking into account factors influencing new registrations, completion rates, and apprenticeship durations. This proposed approach is described in detail in the technical paper, mentioned earlier, which is due for release in February 1983.

In this connection, furthermore, it is intended that the construction component of the supply-side apprentice projection system will be incorporated directly with an enhanced construction labour demand model to be developed in 1983.

In proposing a comprehensive approach to the issue of apprenticeship projection, C.O.P.S. fully realizes the major roles, in terms of advice, intelligence, and data, to be played by provincial governments' apprentice licencing authorities and analysts, and labour unions. The object of the planned technical paper in this area will be to introduce the critical issues and to investigate whether, and how, joint efforts might be established in this very important area.

e) Non-Apprentice Training

One of the main objectives of the C.O.P.S. projections is to assist in decisions on the volume and occupational focus of training programs, both institutional and industrial. To do this, C.O.P.S. proposes to compare projected occupational shortages to a projection of training outputs which assumes a simple extension of current training volumes and courses. These comparisons will highlight the nature and extent of the training changes needed if the shortages are to be prevented. In turn, assessment of these needed changes in the light of known training capacity or funding constraints should indicate those shortages which training changes will not meet.

It is very important, for this purpose, to have a historical perspective on recent training activities and on the subsequent labour market success of training graduates or discontinuants. This information will be very useful in assessing the occupational impact of training, and the system's capacity to adjust to meet anticipated occupational shortages.

C.O.P.S. proposes to assemble as comprehensive a historical picture as it can of training activities, and their contribution in occupational terms. To do so, it will have to address a number of conceptual and practical problems associated with either institutional or industrial training. These are discussed separately below.

i) Institutional Training

An earlier section has described the approach to be taken in estimating the flows from the education system into occupations. In that "Student Flow Model", the effective 'core' of the supply side, school-leavers, by field of study, are translated into new labour force entrants, by occupation. In principle, a similar overall approach is proposed for other non-apprentice training programs. These include:

- vocational training courses at provincial trade schools and related institutions (often including branches of community colleges);

- Canada Manpower Training Program (excluding apprenticeship block release)

Assembly of data on trainees in the above programs, together with their fields of study and subsequent occupation, immediately requires that provincial trade schools trainees and those within the CMTP stream be clearly delineated. This involves two points:

- federal, provincial, and even institution-level training data have to be reviewed and reconciled to identify accurately the number of individuals enrolled in. or leaving, the various

training programs involved. This will require concentrated efforts of federal and provincial analysts, and, while not yet done, is a C.O.P.S. priority.

- CMTP trainees, who by definition have already spent time in the labour force and may be regarded as 'adult' trainees, must be distinguished from other trade school trainees. The latter may be primarily younger students, coming directly from other educational programs. This distinction is important to the overall 'accounting' of the C.O.P.S. supply estimates, to avoid significant miscounts of the overall numbers of trainees, school-leavers, and new labour market entrants involved.

Efforts may also be required to identify training institutions (primarily private trade schools) for which reliable data do not exist, and to attempt to assemble estimates of their output to round out the C.O.P.S. institutional training information.

A second issue concerns the fact that, as with graduates from the education system, training graduates do not necessarily enter the occupations for which they have been trained. To address this problem, C.O.P.S. proposes to use the results of past follow-up surveys of CMTP graduates to assess the strength of the training-

occupation link and estimate the potential occupational impacts of graduates from individual training courses. Similar provincial data will also be assessed, to the extent they are available.

Use of these follow-up data encounter the drawbacks already discussed in an earlier section regarding the education-occupation matrix, i.e.: they are heavily influenced by the economic factors in play at the survey time, and they may not have relevance to future demand conditions. While these drawbacks are well understood, however, it is also expected that future follow-up surveys could update and enhance this information, strengthening the picture of the training-occupation link for particular courses.

Third, use of these follow-up results, combined with historical training outputs, to assess the ability of the training system to adjust to meet projected occupational requirements, will require information on how current and projected training capacities (in terms of physical premises, teaching staff, etc.) could constrain training expansion. Provincial knowledge and judgement will be critical here, and will be sought as an essential part of the COPS process.

Fourth, in terms of the overall "accounting" of C.O.P.S. supply-side flows, it would be assumed that individuals entering institutional training courses would constitute one element of

attrition from the unemployed category. It would also be assumed that these trainees would be drawn from the low-skilled "General Labour" category which contains those occupations on which C.O.P.S. is not initially focussing. Upon graduation from training, however, most of such trainees would be expected to re-enter the labour force in one of the higher-skilled occupations being studied under C.O.P.S. The extent of this occupational transfer via training would depend, however, on the indications from the training graduate follow-up data.

Finally, although C.O.P.S. intends to focus initially on occupations requiring more than one academic year's training, data will fairly readily be available for a much wider array of courses, many of them shorter than an academic year. Notwithstanding the C.O.P.S. occupational focus, it is proposed to assemble all these training data, regardless of course length, and incorporate them into the supply training data base. To do so will require little extra effort, since the data are available, and will support an expansion of the C.O.P.S. occupational focus in years to come.

ii) Industrial Training

Industrial non-apprenticeship training occurs primarily on the job, and can be either firm-sponsored or supported by government. At the federal level, such support is provided by the Canada Manpower Industrial Training Program (CMITP). Several provincial programs also exist.

Industrial training presents an even more challenging array of conceptual and practical problems than does institutional training. In addition, while a number of the institutional training difficulties revolve about data reconciliation and can be addressed through joint federal-provincial efforts, the industrial training difficulties centre on a substantial absence of data, either federal or provincial, together with ambiguity on what the data actually mean. Following paragraphs expand on these diffulties, and outline C.O.P.S. proposals to address them.

In the first place, not all industrial training will be relevant for C.O.P.S. purposes. COPS is interested in training which contributes to the skills available to the labour market at large, and which can be tailored to prevent or minimize occupational imbalances.

In many occupations, however, firms train to meet their own needs, without recourse to the labour market at large, and give training which provides specific skills useful only within the firm, and not 'portable' by the trainee to other firms. In such occupations, vacancies are not reported outside the firm but are filled internally, so that measures of unfilled vacancies do not exist and occupational imbalances cannot be assessed. Industrial training in such occupations is therefore not a focus of C.O.P.S., but is assumed to be of an amount and quality which meets firms' own needs.

Through this criterion, C.O.P.S. excludes from its focus a considerable amount of informal training on production lines, in which each person traditionally learns the job immediately 'above' his/hers on the line, and, over a period of years, moves from one job to the next senior.

Second, it should be noted that a significant proportion of industrial trainees are employed before they take the training. In these cases, the occupational impact of the training must be assessed clearly.

Where the trainees are able to progress from one occupation to another as a result of the training, the occupational impact appears clear. However, if the training involves skill upgrading within the trainee's occupation, it is far more difficult to assess objectively the contribution of the training to occupational supply. For example, without such training, the trainees might have lost their jobs through not keeping abreast of skill developments. In these cases, the taining has not so much added to the supply in the occupation as it has prevented it from declining.

In the C.O.P.S. system projected occupational imbalances assume that those employed in an occupation remain qualified to pursue it until they leave it through the process of attrition (retirement, death, etc.). To the extent that occupational upgrading slows down this attrition process, it can be seen to contribute qualitatively to affecting projected C.O.P.S. imbalances. In principle a means should therefore be found for incorporating such training into the C.O.P.S. framework. This involves, in turn, a capacity to assess the true contribution of such training to maintaining the trainees' skill levels.

In practice, however, this will be very difficult; the thorny question of skill upgrading thus remains one in which extensive further work is required in the C.O.P.S. context.

Third, the entire area of industrial training in beset by major data problems which, until resolved, will limit knowledge of this area and to a considerable extent prevent a proper resolution of the first two conceptual issues. Systematic, basic data are simply lacking on the nature and extent of firms' own in-plant training programs. This makes it almost impossible to tell what training is occurring within firms, let alone whether such training meets the C.O.P.S. 'portability" criterion or focuses on occupational upgrading. There is some evidence that such in-firm training may be very significant in total. Estimates of occupational supply which do not include it may therefore significantly understate real supply flows.

Development of a more comprehensive picture of industrial training activity thus constitutes a C.O.P.S. priority. An important first source of such information on a sector basis will be the program of "Sector Studies" proposed within the overall C.O.P.S. approach.

These studies of individual important industrial sectors will focus both on anticipated major developments which could effect the future occupational "mix" within the sector, as well as on identifying the nature and extent of industrial training undertaken within the sector.

In addition, a close review of existing industrial training data will be undertaken. For the most part, these data refer to the Canada Manpower Industrial Training Program (CMITP) of Employment and Immigration Canada. C.O.P.S. is in the process of assembling data on CMITP trainees and their occupations as a first step towards assessing the role of industrial training in occupational supply.

It is apparent that the assembly of a comprehensive picture of the extent and role of industrial training will take time and effort. It is also clear that this will not occur without extensive assistance and advice from the private sector. This area thus represents one in which private sector participation will be absolutely essential to the success of the C.O.P.S. system.

f) The Armed Forces

i) Introduction

The Armed Forces "draw off" a certain component of the civilian labour force and "re-inject" a proportion of these into the civilian labour force at a later date. C.O.P.S. interest in the flows in and out of the Armed Forces reflects not only a concern for the "accounting completeness" of the supply framework, but also the fact that, while admittedly small in comparison to other sources the Armed Forces are a significant supply source in particular trades specialities and localities. For example, in the aircraft technicians occupations in the Atlantic provinces, historically a majority of persons in the civilian labour force for that trade have had military training in the trade.

It is expected that incorporating the Armed Forces into the C.O.P.S. framework will prove of assistance to those involved in manpower planning in the Armed Forces. The model can also serve to inform educational institutions of the significance of the military as recruiter and of the requirements of the military. Industry will be made more aware of the contribution of ex-military servicemen to the civilian labour force. The inclusion of an Armed Forces component within C.O.P.S. thus requires the continued support and assistance of the Department of National Defense.

ii) Conceptual Approach

The Armed Forces are a unique component of the C.O.P.S. model. Employment of Armed Forces members in public administration and defence is excluded from C.O.P.S. occupational requirements. Full time members of the Armed Forces are also excluded from the labour force estimates of the supply side. In terms of the C.O.P.S. model, persons joining the Armed Forces enter what may be viewed as a state of "limbo" and are exits from the labour force or household. Exits from the armed forces re-enter the C.O.P.S. system.

In terms of the C.O.P.S. model the Armed Forces are somewhat analogous to a training institution. Persons leaving the Armed Forces usually have acquired training and skills in addition to those they possessed on entry. A process of skill acquision takes place. Armed Forces personnel are classified according to job specialties and groups, some of which have direct civilian job equivalent while others do not. For purposes of analysis, the military groups can be treated as the fields of study in an education stream. As with the C.O.P.S. Student Flow Model, there are conceptual links between these military jobs and civilian jobs based upon similarity of skills and Renowledge required to perform them.

There are also the empirical flows to civilian em-

ployment based on the actual experience of persons leaving the Armed Forces. Such flows would be based on follow-up surveys or longitudinal studies of exits.

The steps required to integrate an Armed Forces component into the C.O.P.S. structure are very straight-forward and focus on the entry and exit events. On the recruitment side, it is necessary to project the flow that occurs directly from the civilian education and training systems to the Armed Forces. To be consistent with the student flow model, the projections must be disaggregated by province and education level, and in the case of post-secondary education by degree and field of study. The follow-up surveys of graduates used in the C.O.P.S. enrolment flow model include those persons employed in the military at time of interview. These persons must be subtracted from the flow to the civilian labour force. It is also necessary to project the flows from the stocks of skilled occupational groups, the unskilled labour force and the household sector.

On the exit side it is necessary to project the flows into the civilian labour force and household sector. These estimates must be made by province and occupation. Omission will result in an underestimate of supply, both in total and in occupational terms.

A conversion table is available that links the military job groups to their civilian equivalents. If the job group composition of the projected flow of exits is known, this conversion table could be used to project the "conceptual" or potential flow to civilian occupational groups or clusters. Little detailed data is available on the distribution of the occupations in which those leaving the Armed Forces actually become employed. Additional follow-up information is required.

Many of those persons leaving the Armed Forces are older workers, retiring from the military with the greater part of their working life behind them. The older workers are usually eligible for pension and face diminishing family responsibilities. These characteristics can be expected to influence their subsequent work patterns. Early leavers comprise a major portion of military exits but their characteristics and circumstances are very different. The nature and degree of labour participation of those leaving the military service must be carefully considered and the model should therefore distinguish between early leavers and retirees.

Over the years, substantial numbers of persons, upon retiring from the Armed Forces, have received training under the Canada Manpower Training Program. Such training is designed to equip them with skills marketable in the civilian labour market.

Follow-up data should be available for these courses. Care must be taken to avoid double counting of some of the CMTP flows to the labour force and flows from the military.

iii) Methodology and Data

The initial methodology for projecting the flows in and out of the Armed Forces will be based on recent trends in recruitment and attrition. The education and training composition of entrants to the Armed Forces will be based on recent historical shares. The job skill distribution of early leavers and retirees will be based on recent historical shares as well.

The Armed Forces maintain generally excellent internal data systems in a combination of manual and automaed formats. These systems will be able to provide sufficient information on the characteristics of entrants to the Armed Forces to insure an appropriate integration of the front end on the armed forces component. Information on the technical groups and specialties of exits is also available. Although some statistical problems do exist in this information sources, the data on trades or technical specialties is not seriously afffected.

Follow-up data on the occupations in which military leavers find employment is not currently available at the four digit level. The conceptual flows combined with participation rates for the various groups might be used for some technical

trades and professional groups. Available CMTP data will be used.

In time, more sophisticated models could be built taking into account shifts in military employment practices and occupational needs and the influence of supply and demand in the civilian labour market. As an example, high levels of unemployment and declining shortages of skills have been found to result in reduced attrition form military service. This in turn effects the recruitment needed for replacement. Yet, at the same time, the numbers of persons willing to consider enlisting increase substantially, reducing the difficulties the military experience in finding suitable condidates.

g) Immigration and Emigration

Immigration and emigration flows enter the C.O.P.S. model in two major ways. The first is through the demographic assumptions. The assumptions about net immigration (as well as fertility and mortality rates and interprovincial migration) that were developed in consultation with the provinces and CEIC regional economists were used by Statistics Canada in the preparation of detailed provincail population projections. These population projections were incorporated as independent, or "exogenous" demographic variables in the macroeconomic scenarios prepared as the first step in the C.O.P.S. demand side process. These population projections influence the supply side, since they fuel the enrolment flow model that is the central core of the C.O.P.S. supply methodology to date. The aggregate series of enrolments resulting from this enrolments flow model are also used as exogenous variables in the macroeconomic model.

The second way immigration and emigration enter the model is in the form of flows in and out of the labour force and the 4-digit occupational stocks that form the C.O.P.S. framework. The allocation of emigration and immigration flows according to labour force activity and occupation present some quite different problems both in terms of concept and data availability.

i) Immigration

It is advantageous to consider immigration and emigration separately and in some detail. Immigration is the easiest to deal with in terms of data availability. A wealth of administrative data is available on immigration to Canada and most of the data of interest to C.O.P.S. is stored in a format suitable for electronic data processing. While a detailed review of this data is clearly beyond the scope of this paper, a brief discussion about a few of the most critical variables (occupation, province of destination and labour force participation) will illustrate some of the problems of using administrative data, no matter how excellent and rich the source.

The immigration data system gives the intended occupations of those landed immigrants who declared an intention to work. Non-workers are those who did not declare an intention to work, and are classified as spouses, students, dependent children or retired persons. No doubt many of these non workers will in fact enter the labour force soon after arrival. Longitudinal and cross-sectional studies suggest that the number of immigrants declaring an intention to work substantially understates immigrants' actual labour force participation.

However, if the majority of these additional entrants enter the unskilled or semiskilled labour force, the implications for the measurement of skill imbalances will not be all that serious. Although it is tempting simply to increase immigrants' estimated labour force participation levels it is unlikely that the occupational composition would be unaffected.

Data on immigrants' intended occupations must be used with some caution. Given that intended occupations do reflect to some degree the job qualifications of applicants, there would likely be a good match between intended occupations and those actually realized after arrival. Studies conducted by Employment and Immigration Canada indicate that after adjustments are made for coding error about 75 percent of those intending to work do find employment in their intended occupational group. The higher the skill, the better the match.

Data on the province of intended destination have been criticized on the grounds that many immigrants, (especially those to the Atlantic provinces) drift away to other provinces soon after arrival. In the C.O.P.S. methodology, however, it is the first residence that is required. Subsequent moves will be picked up in the

interprovincial migration module of the C.O.P.S. supply system, according to Census definitions.

A number of options presented themselves for allocating immigration flows by occupation to the labour force. In one, a simple and 'static' historical shares approach, the historical proportion of immigrants destined to the labour force would be applied to the overall level of immigration (independently determined), to project the overall flow of immigrants to the labour force. This overall flow could then be distributed among occupations at the "4-digit" SOC level using those occupations' historical shares of immigration flows.

In this 'static' approach, the occupational composition of the immigrant inflow would be entirely independent of projected occupational demand. The approach would be mechanical, and would not require any judgement on the part of the user. It would be applied to any level of immigration without reference to the labour market consequences. It would also be "policy neutral" — an attractive feature given the sometimes sensitive nature of immigration.

It would also, however, be unrealistic. The fact is that immigration flows <u>are</u> responsive to skill

imbalances, both in Canada and abroad. Much of this responsiveness, furthermore, is "built into" the immigration system, which can be adjusted by changing the administrative procedures and regulations governing immigration to Canada. Simply put, the size and occupational composition of immigration flows to the labour force are, in part, a dynamic adjustment to shifting occupational imbalances, and the degree of responsiveness should be considered a policy variable.

To reflect this, an alternative, dynamic immigration model could be considered which, while responding to projected imbalances, would be compatible with a "policy neutral" approach to immigration as a whole. A number of simple 'dynamic' approaches were considered which would allocate the occupational flow of immigrants on the basis of the interaction of domestic supply and demand. Domestic supply would be defined as the supply from all domestic sources including training, interprovincial migration, interoccupation mobility, etc., less the loss due to emigration. As with the historical shares approach, the starting point would be the gross levels of immigration used in the macroeconomic scenario. Historical proportions of those immigrants intending to work could be used to determine the numbers entering the

labour force. Family class immigrants could be allocated on the basis of historical occupational composition, since these are the least sensitive to occupational imbalances. The numbers of persons entering the labour force for all other classes would comprise a "reserve labour pool". This reserve could be allocated according to the demand imbalances based on the requirements and domestic supply. Historical patterns and judgements about the availability of overseas workers could be considered as well. Conceptually, if the imbalances were clearly not of sufficient magnitude to absorb the reserve labour pool, the immigration flow could be lowered by successive approximation.

Of course, this 'dynamic' methodology would be totally unacceptable. Technically, the model would be too crude and judgemental, with substantial refinement required. Of far greater concern, however, would be the questions it raised about the role of C.O.P.S. vis-à-vis immigration decisions. If, through a dynamic immigration model, C.O.P.S. sought to estimate the number and occupational composition of immigrants implied by its projected occupational imbalances, this could be seen, effectively, as a pre-emption of the federal-provincial consultative process on immigration levels and content. There would

also be serious implications for the role of existing structures, such as those for determining immigration selection points.

Such implications would not be consistent either with the spirit or with the intent of C.O.P.S., which seeks to provide a framework to assist federal, provincial, and private sector analysts and planners. To establish such a framework in the immigration field, therefore, C.O.P.S. will project domestic skill imbalances, as described above, and will also have available a readily accessible data base on detailed historical immigration flows and temporary work visas, by occupation, together, perhaps, with a number of optional methodologies with which users could allocate immigrants by occupation. Although aggregate immigration level projections will be required for the macroeconomic model (as described earlier) these immigrants will not be allocated to the occupational stocks but rather to a "reserve" labour force, whose size and occupational composition would be determined through federal provincial consultation, analysis, and policy decision. C.O.P.S. would thus provide the data base, and framework, in which these discussions and decisions would take place.

ii) Emigration

Emigration must be treated somewhat differently. Because emigration cannot be directly influenced by Canadian government programs and policies, it clearly cannot be considered a policy variable. For this reason, it was decided to subtract emigration from the domestic supply stocks and treat emigration as strictly an "exogenous" variable.

Emigration is subject to the same conceptual issues as immigration. As with immigration, emigration is responsive to imbalances overseas and to the immigration policies of foreign governments. However, given the number of countries receiving Canadian emigrants, it would be difficult to incorporate these into the model in other than a highly judgemental fashion. The increasing dispersion of emigration from Canada is a complicating factor; in 1961-62 over 70 percent of Canadian emigrants went to the U.K. or U.S.A., but by 1978-79 these had declined to under 40 percent.

The major obstacles regarding emigration are therefore not conceptual or methodological but rather result from the almost total lack of data (occupational or otherwise) on emigrants from Canada.

Highly aggregated post-censal estimates of the annual volumes of emigrants from Canada are prepared by Statistics Canada. Information on country of destination, however, is incomplete and must be used with caution. Comprehensive information on emigrants' occupational composition is available only for emigrants to the United States.

Clearly, substantial work is needed to acquire potentially available data before comprehensive methodologies in this area can be developed. An interim measure would be to use the U.S. data as a proxy for the entire emigration flow from Canada. The proportion of those destined to the U.S. labour force could be applied to the Canadian emigration projection to estimate the gross international outflow from the Canadian labour force. This could be applied to recent observations of the distribution of intended occupation of Canadian emigrants to the U.S. to produce gross international outflows by occupation. These could be allocated by employment share among the provinces.

Because the selected worker movement to the U.S. focuses on highly qualified manpower it is likely that the skill and education mix of the flows of Canadians

to the U.S. exceed the average of Canadian emigrants as a whole. Perhaps the occupational distribution of emigrants to the U.S. may be taken to represent a "worst case" scenario for the emigration of those with professional or high-level skills. In any case, the data problems posed by emigration are of concern in the C.O.P.S. context, and may not be resolved satisfactorily for some time.

h) The Household Sector

i) Introduction

As participation rates of women are increasing and labour force re-entrants are growing, the household sector has become a more and more important source of labour supply in the Canadian economy. In view of this point, estimates of flows to and from households, in both aggregate and occupational terms, by province as well as for the nation, are to be integrated into C.O.P.S. as an essential part of the supply framework.

ii) Sector Definition and Concepts

The household sector includes all individuals of working-age not in the labour force, except those going to school. Members in this sector are largely housewives and retirees who, often referred to as "secondary" workers, have no permanent attachment to the labour force but move into and out of the labour force in response to economic conditions. For example, during a recession period when high unemployment of primary workers prevails, some may be pushed into the labour force in an attempt to help maintain some given level of family income; meanwhile, others who are already in the labour force become discouraged and withdraw from it because of their long duration of unemployment.

Not only do household members move into and out of the

labour force, but they also move into and out of the education system. They enter educational institutions to receive either formal education or special training and upon termination, move directly into the labour force or via the household sector.

In the C.O.P.S. framework, it will be necessary to develop means of projecting the potential flows from the household sector into the labour force, in response to anticipated circumstances. In contrast to some provinces' approaches, where the size of the flows from the household sector is derived as a residual, after potential imbalances are calculated, the C.O.P.S. approach would propose to incorporate projected flows from the household sector, before apparent imbalances are derived, leaving immigration as the eventual residual.

As part of an expanded approach to estimating attrition, C.O.P.S. will also require projections of flows from the labour force to the household sector, through retirement or labour force withdrawal. These household-labour force flows, in both directions, furthermore, will require some detailing by occupation, if their impact on occupational imbalances is to be assessed.

These requirements of the 'household sector' submodel are extremely onerous; a fully satisfactory treatment of the sector may exceed the data and analysis likely to be available to C.O.P.S. in

the short-term. Extensive further developmental work is required in this area.

iii) The Methodology for Projections

a) The Approach

Within the C.O.P.S. framework, it will be necessary to develop methods for assessing and projecting flows between the household sector and the labour force (in both directions), on an annual basis. These flows will reflect the effects of a number of causal factors, among which would be economic conditions and demographic characteristics.

In order to project the likely size of these future flows, a relationship should be established between the likelihood of these flows and their causal factors — preferably by using a rigorous analysis.

One means of conducting this analysis is within the framework of a 'Markov chain' model, which estimates the flows between labour force states in terms of "transition probabilities" which reflect the likelihood of moving from one state to another. Given the size of the starting stocks in the household sector and the labour force, the size of the flows between them over successive time periods can be determined by the relevant transition probabilities, taking into account the impacts of migration and

demographic factors on the size of the stocks themselves. For C.O.P.S. purposes, the supply of labour from the household sector, on an annual basis, would reflect the net flows over the year between this sector and the labour force.

b) The Data

A complete analysis of these flows would require extensive data, not only on the causal factors affecting the flows between labour force states but also on the gross movements between detailed labour force and non-labour force categories. Work to date has identified, however, that the available data do not fully satisfy C.O.P.S. requirements vis-à-vis the household sector. Not only do the Labour Force Survey "Gross Movements" data have no explicit household detail, but they are also only available for the 1977-81 period. This may prevent a rigorous analysis of the size of, and the factors affecting, flows of individuals in and out of the household sector.

Faced with such difficulties, C.O.P.S. is therefore investigating another data source, the "Annual Work Patterns Data" from the Labour Force Survey. These data, currently available for 1977-1980, may be used to shed light on the size of the household labour force flows in this period, and may provide a certain amount of geographic and demographic detail on these flows. These data, however, would not be expected to yield occupational information,

but could provide potentially useful educational detail.

As noted, the capacity for rigorous analysis in this area may well be curtailed by data difficulties, pending the development of new sources or a more imaginative use of existing ones.

(i) Interprovincial Migration

(i) Introduction

Interprovincial migration affects the C.O.P.S. supply framework in two ways. First, interprovincial migration is one of the most important components of change in provincial populations. In addition, the patterns of net interprovincial migration are subject to considerable year over year variation which makes them very difficult to predict. Consequently, great importance has been attached, within the overall C.O.P.S. framework, to obtaining reasonable and consistent assumptions about future levels of net interprovincial migration in the preparation of provincial population projections. The nature of these assumptions, and the process by which they were derived, have been described in an earlier section.

The national population projection, incorporating the interprovincial migration and other demographic assumptions, is used in developing the C.O.P.S. demand side macroeconomic scenarios. Of course, since interprovincial migration sums to zero, this factor has no explicit effect on the national level scenario. But at the provincial level, complex relationships exist amongst population growth, interprovincial migration, the national economic projections and the provincial shares of national economic growth. Patterns of interprovincial migration

will reflect any interprovincial differences in economic growth implicit in the macroeconomic outlook. In turn, shifts in population will affect the provinces' shares of the national industry employment projections and their shares of the national labour force. Therefore, incorporation of these interprovincial migration projections into the C.O.P.S. macroeconomic projections means that any provincial level labour imbalances ultimately developed through the C.O.P.S. model incorporate these interprovincial migration assumptions, and must be interpreted in this light. But

The second major way in which interprovincial migration explicitly enters the C.O.P.S. model is via its occupational distribution which significantly affects the potential occupational supply stocks by province. Given that the C.O.P.S. model will produce imbalances at the provincial level, it is absolutely essential to project occupational flows amongst provinces, and to measure the resulting changes in provinces' occupational supply stocks.

ii) Methodology and Data

An interprovincial occupational migration component must therefore be integrated into the C.O.P.S. framework. The

first step is to develop some simple definitions. In terms of interprovincial migration, an outmigrant from a province is any person who leaves the province to take up residence in another Canadian province. An inmigrant is any person who moves into the province and takes up residence. Students living away from home in another province, commuters and many workers taking short term employment in other provinces are therefore not migrants. These definitions are consistent with those used in the computation of the net interprovincial migration statistics described above.

The next step is to identify the numbers of migrants who are labour force participants, together with their occupations prior to and after the move. However, because of data limitations it is difficult to define the occupational dimensions and labour force status of the flow of migrants in a manner that is entirely consistent with the concepts and definitions underlying the C.O.P.S. labour force stocks (which are essentially annual average figures consistent with those of the Labour Force Survey).

If the regular monthly Force Survey identified, each month, those respondents who had completed an interprovincial move since the preceding month, the information collected regarding their labour force status, occupation, etc., before and after the move could be averaged over the year, and would be entirely

consistent with the annual average figures used in the overall C.O.P.S. estimates. Such data, however, are not available. Furthermore, it is questionable whether the numbers of migrants identified each month would be great enough to provide statistically valid results at any level of occupational detail. Other sources of data must be used.

The principal source of detailed occupational data on interprovincial migration has been the ten-year Census. This source gives "four digit" occupational detail similar to that used in the Labour Force Survey. Since interprovincial migrants are those who resided in another province on June 1 five years earlier, many types of interim moves are missed. Respondents' occupations are taken as those at which they worked in the week before the Census (for those employed) or (for those unemployed) the occupation at which they had worked longest since the beginning of that year. For the most part, the jobs upon which the occupational data are collected are those held <u>after</u> the move; no "pre-move" occupational information is collected in the Census. Furthermore, the "post-move" job reported may or may not be the first job held after moving.

A second source is the August 1982 Supplement to the Labour Force Survey. This survey gathered data on all interpro-

vincial and international moves of the respondents since June 1, 1976. The data on migrants includes detailed data on education levels, as well as considerable information relating to their most recent move, including their occupation immediately before and after that move, and their labour force status immediately before and after that move. It is expected that information on the most recent move will be skewed to the last year of the six year period and will form a sort of weighted historical average.

These data from the supplementary survey form an important element in the C.O.P.S. methodology for projecting interprovincial occupational flows in a manner which produces estimates consistent with those of the monthly Labour Force Survey. The model begins with gross interprovincial migration flows that match the net interprovincial migration assumptions used in the provincial population projections. Because two separate sets of assumptions of net interprovincial migration were used, the model will project two sets of interprovincial occupational flows.

A historical proportion of the numbers of migrants who were 15 years of age and over will be applied to the gross numbers of interprovincial migrants to produce estimates of the numbers of migrants of working age. The Survey information on the labour force activity of migrants before and after the most recent

move will be used to determine the numbers of labour force participants leaving and entering the provincial labour market due to interprovincial migration. The occupational composition of out migrants from a province's labour force will be based on their job in the month prior to moving, while for in migrants the occupational composition will be based on their job in the month after moving. By concentrating on respondents' occupations and labour force status immediately before and after the move, the supplementary survey provides data conceptually comparable to the monthly Labour Force Survey definitions.

Although the estimated occupational distribution of migrants will clearly be required, in some detail, in projections of occupational supply at a "4-digit" level, the supplementary survey will not provide occupational detail beyond three digits. Indeed, for some jurisdictions the occupational detail will be even more limited. To address this shortcoming, however, the occupational detail from the ten year Census can be used to disaggregate the occupational flows of labour force members to the four digit detail required in C.O.P.S. Should it prove necessary to estimate the occupational distributions of employed and unemployed migrants separately, the distribution of the unemployed, by occupation may be estimated by reference to the occupational distribution of Unemployment Insurance claimants.

The preceding methodology is basically a historical shares approach, used to break down, by occupation, the number of net interprovincial migrants assumed at the outset of the exercise. Within the explicit structure of the current C.O.P.S. model, the level and composition of the flows are independent of provincial requirements or imbalances produced in the model. This may be acceptable if the relative growth rates and provincial shares of labour market imbalances remained constant. However, in the long run, it will not be satisfactory, given the volatility and responsiveness of net interprovincial migration to such factors.

In time, therefore, C.O.P.S. would hope to develop more sophisticated methodologies in which the rate and composition of interprovincial occupational flows would respond to skill shortages and surpluses in the current or preceding periods in the various jurisdictions (Push-pull model). Such methodologies however, require major improvements in data as well as the use of qualitative information and judgement. Significant enhancements of this sort will be included in the C.O.P.S. construction industry sub-system. In the short term, however, the more "static" approach appears the starting point most consistent with available data and analysis.

j) Interoccupational Mobility

Movement among occupations constitutes a major source of labour market adjustment. Individuals may move 'laterally' among occupations, perhaps choosing among them at the start of their careers or later on, taking advantage of opportunities as they emerge. People also move 'vertically' among occupations as they follow a career path in their field.

The extent of such interoccupational movement, however, is not at present well understood. Yet a much improved understanding of this area will be essential to the analytical completeness of the C.O.P.S. system, particularly in assisting the interpretation of its projected occupational imbalances. The importance of accurate information on "job ladders" in this connection is particularly clear. In many firms where such "job ladders" exist, the firm may recruit externally only to fill the job at the "bottom rung" of the ladder, relying on subsequent internal promotion to fill vacancies further up. This bottom-rung "port of entry" occupation may be the one in which graduates in that field tend to find their first jobs, and thus the one identified when recent graduates are surveyed on their post-graduation experience. Although C.O.P.S. occupational requirements in this area will be expressed in terms of all occupations on the job ladder, the observed occupational supply will tend to be concentrated primarily in this single bottom rung "port of entry" occupation.

Unless the composition of the job ladder itself is well known, simple supply/demand comparisons will produce a meaningless result: shortages in all occupations on the ladder except the "port of entry" (the bottom rung), where there is an enormous surplus. Clearly, to permit appropriate demand/supply comparisons, there is a great need for more research into vertical occupational mobility patterns.

Similarly, information and analysis regarding lateral interoccupational movement is essential if the true capacity of labour supply to satisfy occupational requirements is to be assessed.

From the C.O.P.S. point of view, the most fruitful initial approach to the issue of interoccupational mobility would be to seek to identify groups, or 'clusters' of occupations that are characterized by internal movement among the occupations within the cluster but relatively little movement between these occupations and those outside the cluster. These clusters may be essentially groupings of similar occupations within which individuals can move laterally, or they may reflect career or job ladders up which people tend to move 'vertically'.

C.O.P.S. proposes to explore how three main approaches can be employed to assemble analytically useful information on interoccupational mobility.

First, and most obvious, is the need to learn as much as possible from the literature about the extent and patterns of occupational movement in Canada. Considerable insight can probably be gained from a review of empirical or case studies, whether they are broadly based or more focussed in particular occupational areas.

Second, C.O.P.S. proposes to develop its own data sources in this respect. There are two of these, as follows.

i) As part of the C.O.P.S. Sector Studies program, information will be gathered on the operation of internal job ladders within firms in the sector. Occupations which are "ports of entry" will be identified, as will the career progressions stemming from these. To the extent that the Sector Studies gather data from employees, there will also clearly be an opportunity to assemble employees' responses regarding present and previous occupations, and to use these to learn about their past occupational mobility patterns.

ii) Through the operation of the Unemployment Insurance longitudinal data base within CEIC, it is possible to track UI claimants' occupational changes over time to give useful

information on the group of occupations that individuals pursue over time. At the same time, it is recognized that focussing on UI claimants alone may produce a bias which can be reduced if job leavers as a whole can be tracked occupationally. Work is underway to determine what is necessary to conduct such a study of a sample of job-leavers.

Third, C.O.P.S. proposes to use the occupational mobility potential of the new C.E.I.C. occupational classification system, JOBSCAN, as the system itself is put in place in future years. On a long term basis, this approach could provide the most significant basis for assessing interoccupational mobility.

Briefly, the JOBSCAN occupational classification system will recognize that the capacity to obtain a clear occupational picture depends both on the methodology used to collect information and on the classification system employed to arrange and present it. It will therefore, aim to address both of these concerns.

As a classification, JOBSCAN proposes to stress patterns of occupational entry, progression, and mobility. It would therefore seek to incorporate features such as the following:

- The concept of occupation, as a group of similar jobs, should be refined to eliminate cases of over-specificity, particularly in the definition of unskilled occupations.
- Occupations should be grouped into families based as nearly as possible on observed patterns of occupational mobility and characteristic career progression. Mobility should be greater within these families than between them.
- The occupational families should be subdivided into groups that are homogeneous with respect to skill level.
- The system should identify and isolate, as far as possible, the usual ports of entry between external and internal labour markets and ports of entry into families of occupations which are related by technical or functional skill. These entry level groups can be more easily associated with known sources of supply.
- Such a structure should be accessible to analysis at different levels of aggregation and in different dimensions to yield information on overall

or composite skill levels within families and within the labour force as a whole, and reveal changes in skill demand related to sources of skill acquisition and shifts between occupational families.

However, because any static or rigid occupational classification will contain shortcomings relating to its capacity to reflect changing circumstances, the JOBSCAN classification system will be supported by a database capable of revealing through numerical analysis the actual skill patterns in the labour market as they change through time. JOBSCAN is therefore being developed as a data base composed of worker skills and experience and the requirements of employers when hiring, expressed in similar terms. This data base will allow the development of an empirical picture of worker mobility and clarify the relationship between mobility and transferability of skill.

The development of the new occupational classification will involve several procedures. While parts of the current classification system which meet the proposed criteria might be retained, a large proportion of the national data base will have to be reconstructed. Patterns of mobility, hiring requirements, and training will be revealed in sector studies or special studies undertaken

for this purpose. Specific skill surveys using JOBSCAN data collection instruments will be used to clarify the composition of individual occupational groups. Occupational analysis will be undertaken to identify new or emerging occupations. It will also be essential to maintain historical continuity in the occupational data. To achieve this, it may be necessary to code a sample of past and future census returns to both the current and the improved classification system, to establish a basis for converting information from one to the other. In summary, JOBSCAN will contain an improved fixed occupational classification system together with a flexible and continuous underlying data base which will illuminate in detail the actual patterns of skill transfer and interoccupational mobility, and patterns of skill commonality and potential for mobility in the future.

k) Attrition

The issue of attrition in the C.O.P.S. model is closely bound up with the specific issues, discussed above, of interprovincial migration, the household sector, unemployment, and labour force aggregates. Simply stated, if C.O.P.S. proposes to estimate the flows into the labour force from individual sources, it will be necessary, in terms of the overall 'accounting' of the C.O.P.S. system, to estimate flows from the labour force back to some of these supply sources. Such outflows estimates furthermore, will ideally be required on an occupational basis. Because of the C.O.P.S. focus on provincial level detail, these estimates will also have to incorporate as much of a provincial breakdown as possible. Interprovincial migration flows will also have to be separately identified.

The attrition model traditionally used in the COFOR[1] approach includes estimates of net labour force withdrawals and retirements, and implicitly does not permit a return to the labour force. It assumes these withdrawals and retirements reflect strictly age and sex,

[1]The Canadian Occupational Forecasting Program, conducted by Employment and Immigration Canada.

and that they are not influenced by occupation (except to the extent that the age/sex distributions of occupations vary).

Because C.O.P.S. will be developing estimates of a number of the individual flows into the provincial labour force, it will require separate estimates of the individual flows out of the provincial labour force. This will mean, first, that estimates of interprovincial migration will be needed by C.O.P.S. Second, other individual flows out of the labour force through death, retirement, emigration, etc., will require specific detailing. Although the Census based data used in the COFOR attrition estimates may still be of considerable use especially in identifying occupation-specific mortality rates, these will have to be supplemented by further estimates.

To provide such further estimates, C.O.P.S. will be investigating a number of data sources, among which are the following:

- American data on the emigration of Canadians to the U.S. may provide some occupational detail on the emigration outflow;

- improved and up-to-date data[1] on interprovincial migration by occupation may permit some estimates of these flows;

- labour force Gross Flows and Annual Work Patterns data may shed light on the overall size of flows between the labour force and non-labour force categories, although the occupational composition of these remains a major difficulty.

In summary, the success of C.O.P.S. in addressing attrition questions will be related to its capacity to identify and estimate a large number of individual labour force flows. As with so many others, the estimation of these will require time and effort.

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[1] From 1981 Census estimates and those from the 1982 August Labour Force Survey.

1) Labour Force Aggregates and Unemployment

i) Introduction

In projecting occupational requirements and supply, it will be necessary for the C.O.P.S. system to recognize, and take into account, the fact that the projection period is beginning in a state of substantial imbalance and excess supply. Unemployment must therefore be incorporated, both conceptually and practically, into the C.O.P.S. framework as a source of occupational supply. As with school-leavers, or labour force re-entrants, from households, etc., the unemployed form a reservoir of labour which can be drawn on in order to fill vacancies. This section discusses some of the central issues surrounding the incorporation of unemployment into the C.O.P.S. framework, and presents the approach proposed within the C.O.P.S. system itself.

ii) Major Issues

a) The Need for Estimates of Unemployment, by Occupation

The question can be raised whether separate projections of unemployment by occupation are in fact needed by the C.O.P.S. system, or whether the unemployed can simply be grouped, with those not in the labour force, into a "non-employed" category. This category would form a large reservoir of labour theoretically capable of filling vacancies, and could be seen as "labour supply" in

its broadest sense. However, notwithstanding the definition and measurement difficulties which may be encountered in distinguishing the unemployed from those not in the labour force, there are a number of reasons for seeking to separate the two in the C.O.P.S. framework.

In the first place, it may be argued that when vacancies develop the unemployed are a more "immediate" source of labour than those outside the labour force. Knowledge of the likely capacity of the unemployed to fill emerging vacancies is therefore more necessary to assessments of whether or not the vacancies will persist, unfilled. Even in Labour Force Survey definitions, for example, the unemployed are distinguished from those not in the labour force by strict labour market activity criteria, emphasizing their greater immediacy as a labour supply source.

Second, the information on the occupational distribution of the unemployed is considerably better than that relating to the non-labour force. Labour Force Survey estimates, combined with data on UI claimants, have the potential for estimating the occupational distributions of the unemployed to a "four-digit" level. These distributions of course rely on a number of simplifying assumptions, including the key assumption that an unemployed person's occupation can be usefully defined in terms of his <u>last occupation</u>, rather than the occupation in which he eventually finds a

job. Similar detail on the occupational distribution of those not in the labour force does not exist. Nor would such detail on the non-labour force tend to be as meaningful as it would for the unemployed; those outside the labour force would likely be subject to a much greater degree of skill erosion, etc., which would seriously affect those occupations for which they could effectively compete.

For these conceptual and practical reasons, therefore, C.O.P.S. proposes to incorporate into its supply framework estimates of the occupational distribution of the unemployed. For the non-labour force, and in particular, the household sector, as noted in an earlier section, efforts will be made to identify other characteristics, such as their educational attainment.

b) 'Macro' Versus 'Micro'

The macroeconomic model used in the C.O.P.S. demand-side produces projections of labour force, employment, and unemployment at the national level. Provincial-level projections of employment will also be developed in conjunction with provincial governments. Provincial-level projections of participation rates, applied to provincial population projections (independently assumed) can provide provincial level projections of unemployment and unemployment rates, for each of the many economic growth scenarios used. All

of these estimates will be expressed in terms of annual average figures, or 'stocks'.

At a completely different, or 'micro' level, projections will be developed which estimate, among other things:

- the expected flow of school-leavers or training course graduates into the labour force, by occupation;
- the anticipated flow of individuals into the labour force from the household sector (perhaps using to some potential education-occupation relationships);
- the estimated potential flow of interprovincial migrants into the province, by occupation;
- attrition, by occupation, through death, retirement, etc.

The majority of these 'micro-level' data, in short, will be expressed on an occupational basis, and will constitute 'flows' which alter the 'stocks' of available workers.

A key feature of the C.O.P.S. system will be to ensure

that the various 'micro' level, or 'flow' estimates, when combined, produce changes in the 'stocks' which are consistent with those projected at the 'macro' level. Expressed otherwise, the individual, detailed occupation-level estimates of supply-side changes must, when taken together, 'jibe' with the aggregate supply figures estimated by the macro model. Failure to do so indicates an inconsistency within the system as a whole.

This general requirement for consistency between the occupation-level and overall estimates raised specific further conceptual and practical issues. It must first be noted that the 'macro' level projections establish projected aggregate provincial levels of employment, unemployment, and labour force. The 'micro', estimates must produce projections at the occupational level which are consistent with these aggregates. For employment estimates, such consistency is easily achieved; overall employment totals are directly translated into industrial and occupational terms within the C.O.P.S. framework, using, among other things, an "occupation-industry matrix". For unemployment, however, a similar direct translation into occupational terms is much more difficult.

In the first place, unemployment estimates, by occupation are a product of the match between occupational requirements and supplies. The occupational distribution of unemployment will not therefore be directly estimated, but must be derived from the

comparison of demand and supply on an occupational basis. To arrive at estimates of unemployment by occupation thus, in principle, requires the joint operation of the C.O.P.S. supply and demand modules.

Second, unemployment by occupation is in any case a much less concrete concept than employment by occupation. While the employed are in identifiable jobs, the unemployed are in a position to accept a wide variety of jobs in a similar array of occupations. An unemployed person's last occupation, usually regarded as the occupation "in which he is unemployed" may in fact bear little resemblance to the occupation in which he subsequently finds a job.

iii) Potential Approaches

The final C.O.P.S. approach to addressing this issue is under development and requires further analysis and research. The approach, however, has a number of features, which are being further refined, as follows:

a) The very concept of "unemployment by occupation" requires a great deal of work. Although unemployed individuals may be grouped according to their last occupation, judgements will be required, based on data on interoccupational mobility, regarding their likely capacity to fill emerging vacancies in other occupations.

b) Although 'stock' estimates of unemployment, by province, may be projected at the 'overall' level by the C.O.P.S. macroeconomic model, the occupational distribution of unemployment cannot be projected directly but must be derived from the 'match' between occupational requirements and supply. This 'match' will require, in turn, that the 'flows' affecting the occupational composition of supply (new school-leavers, etc.) are estimated on an occupational basis as well as possible, and that the various components of attrition are all accounted for. This will involve significant further conceptual and data issues which warrant a technical paper of their own, and which cannot be addressed fully here.

c) Incorporation of an occupational 'match' in the C.O.P.S. process implies that as a result of the match, in one year, the occupational composition of unemployment may shift, on the one hand, while unfilled vacancies persist, on the other. This situation of disequilibrium will likely influence the nature of the match in the following year, and so forth. What is implied by this, in turn, is that the final C.O.P.S. approach is likely to be a dynamic one, in which the match in each year influences the occupational composition of unemployment, and thus the supply, and balance, of the next year.

The full details of this entire approach remain to be developed. It is clear, however, that work done to date on C.O.P.S., while providing some early answers, has in many cases only clarified some of the questions.